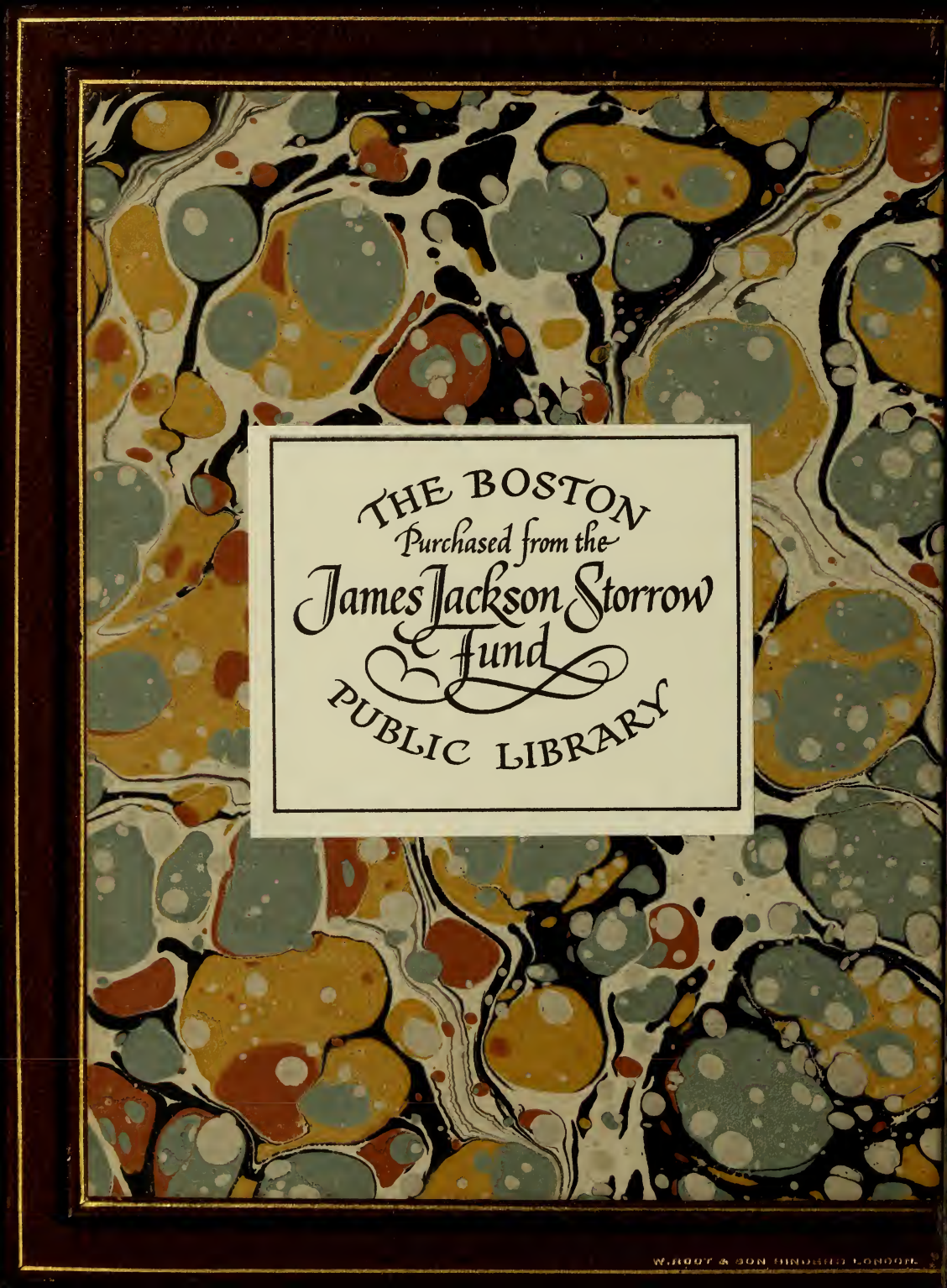
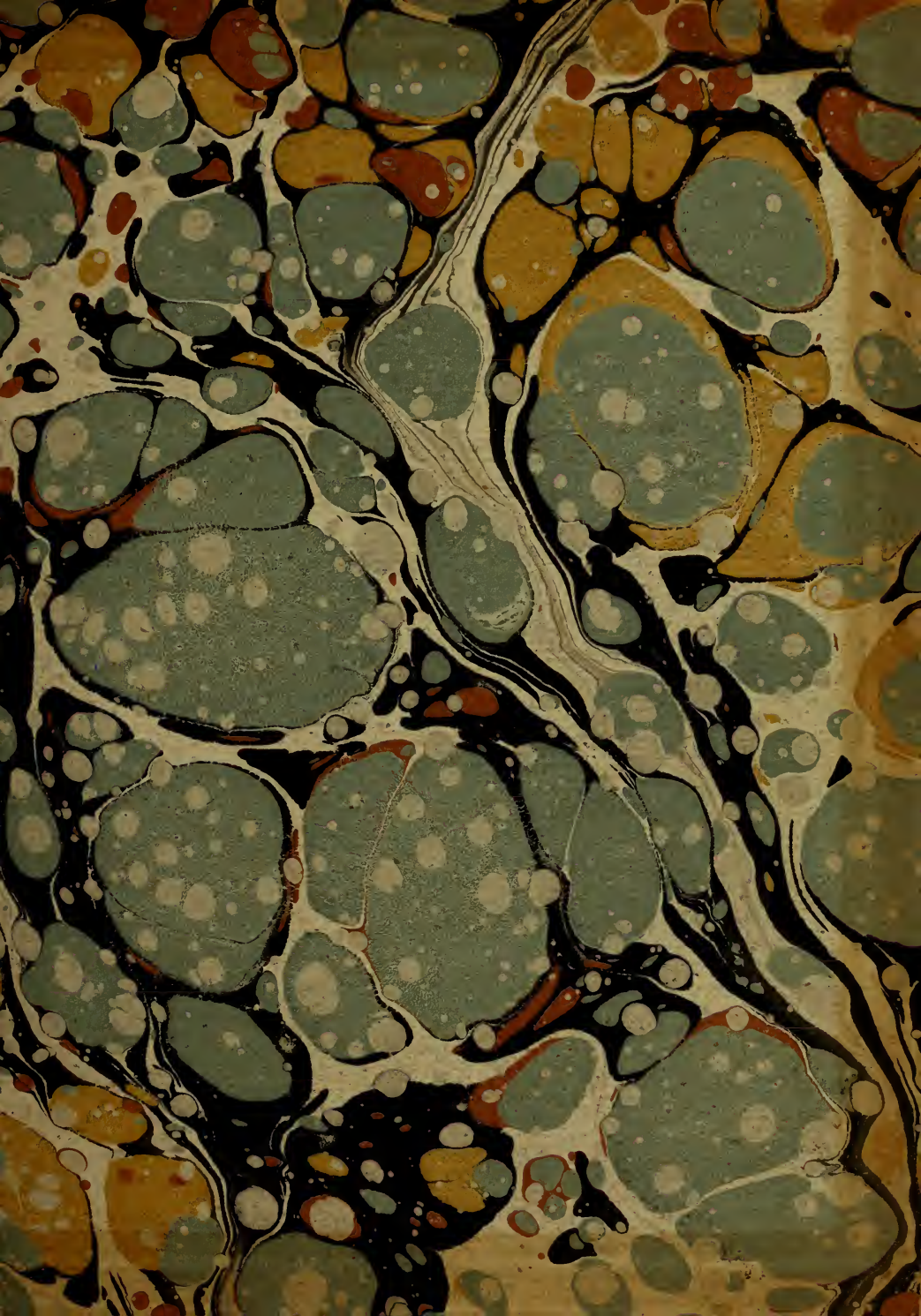
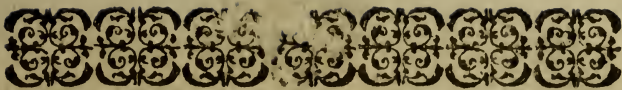




The book cover features a complex marbled pattern with large, irregular shapes in shades of yellow, green, and red, set against a black and white background. A central rectangular label with a thin black border contains the library's name in a mix of serif and script fonts. The text is arranged in a circular fashion around the word 'Fund'.

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CERTAINE
vwayes for the ordering of
Souldiours in battelray, and setting
of battayles, after diuers fashions, with
their maner of marching: And also figures
of certayne newe plattes for fortifica-
tion of Townes: And moze ouer,
holwe to make Salt peter,
Gunpowder, and di-
uers sortes
of Fireworkes or wilde fyre,
with other thinges ap-
pertayning to the
warres. Gas-
thered &
set
forth by Peter VVhitchorne.

Imprinted at London by
VV. VVilliamson: for
Ihon VVight.

Anno. 1573.



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A perfecte rule to bring men into

a square battell, of what number so euer they be.

Cap. 1.



Or to make a square Battell of a number of men, or of an Armie, the folwefquare roote or Quadzante number of them, muſte be taken, and ſo manye as the ſame roote contaynes, ſo manye oughte to be ſet in araye. As ſor example in a littell number,

for the better vnderſtanding thereof: Admitte there be a .100. men, the folwefquare roote of .100. ought to be taken oute, which is tenne: Then putting tenne of theſe men in a rancke, there will be tenne ranckes, ten to a rancke. Whiche tenne ranckes placing them ordinarlye, the one behinde the other, ſo that all the diſtances that ſhall be betwene man and man, as well on the ſides, as beſore and behinde be equall, ſuche .100. menne will make a folwefquare battaile, as by the ſigure here following appeareth.

Head

o	o	o	o	o	o	o	o	o	o	o
o	o	o	o	o	o	o	o	o	o	o
o	o	o	o	o	o	o	o	o	o	o
o	o	o	o	o	o	o	o	o	o	o
o	o	o	o	o	o	o	o	o	o	o
o	o	o	o	o	o	o	o	o	o	o
o	o	o	o	o	o	o	o	o	o	o
o	o	o	o	o	o	o	o	o	o	o
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Flanke

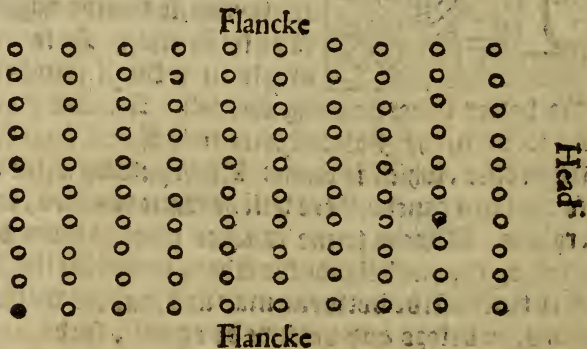
Flanke

A.ij.

But

The ordering of Souldiours

But for that men ordered in battelraye , stande not, nor marche not, as aboue is supposed, I meane in equall distaunce, for that euery man (as Megetius affirmeth) would haue for largenesse thre fote, that is from shoulde to shoulde , and for lengthe seuen fote, that is thre fote before him , and thre fote behinde him , and one fote that his owne person will occupie, for whiche cause the aboue written order, menne standing according to the sayde ordinarie , distaunce, shall not be a iuste sowlesquare, but the lengthe thereof shall be .70. fote, and the bredthe .30. fote, as appeareth by the figure following.



And where some number of men commeth not after suche sorte to be souldersquare, as .200. the roote whereof is .14. althoughe there be .4. ouerplus: in this case there ought to be put fouretene in a ranke, & the sayd battaile will come neuerthelesse to be souldersquare: That is, it shall be of .14. ranckes of menne .14. to a rancke, and as for those soulders menne that are ouerplus out of the araye, the Sergant maye place eyther in the taile thereof, or elles where seemes him best oute of that order:

Likewise after this manner, an army of men howe
greate a number so euer it bee, maye be broughte into a
fowle.

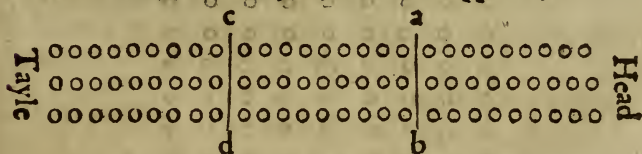
forwesquare, as for example, admitte there were an armye of .35000. of these .35000. menne, the forwesquare roote is to be taken oute, according to the order that I haue declared befoze, and the same shall be founde to be .187. and .31. menne remayning ouerplus, so that placing .187. menne in a rancke, suche an armye will be in fashion forwesquare, that is, it will amounte vnto .187. ranckes. .187. menne for a rancke. And as for the .31. odd men, the Capitaine may appointe where he shall thinke good.

¶ To knowe howe many men maye marche in a rancke, and at a sudden to bring them into a forwesquare battaile, so that their Ansigne, may come to be in the midst.

Cap. 2.



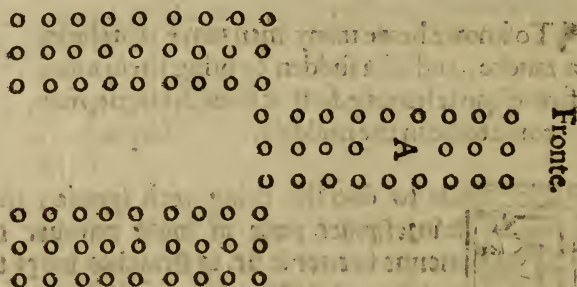
Or to doo this thing with speede, the forwesquare roote of what number of menne so euer it be, is straighte waye to be taken: and if the same roote be so that it maye be equally deuided into thre, so many as shall be the thirde parte of that roote, so many of the saide menne for a rancke oughte to marche by the waye. As for example, if the men that are to be conducted, be .81. the roote of those .81. muste be taken, the which is .9. And for as muche as the roote of this maye equally be deuided into .3. and the thirde parte thereof being .3. the sayde .31. menne must therefore be made to marche in ioyneing thre in a rancke, and they shall make in all .27. ranckes, as here vnder appereth.



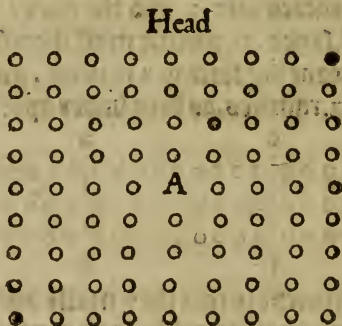
And when neede is that they muste bee broughte into a forwesquare battaile, all these .27. ranckes would be deuided

The ordering of Souldiours

deuided into thre equall partes, as is declared by a b. and c d. So that to euery parte there come to remayne 9. ranckes, thre men in a rancke, and afterwarde the firste parte that is in the Fronte must be caused to stay, and the other twaine to procede forwarde, the one on the righte hande, and the other on the lefte hande of the firste (now standing still) vntill the heade of Fronte of eyther of the saide two partes doe vnite or come to be euen with the heade of the firste, and there to stay. As by the figure following may be vnderstande.



The whiche thre partes thus broughte and ordered, shall make a sowesquare battaile, as appeareth by this figure following: and to cause that the Ansigne doe fall in the middelt of suche a battaile, alwayes it oughte to be placed in the middelt of the firste parte, as befoze appeareth in the pointe. A.



But to knowe howe to deuide the sayde. 27. ranckes into thre equall portions without standing to tell nyne ranckes, considering that if it were a great number of men, it should be a thing very long so to do: therfore seeing that to euery number of men, there is commonly placed a rancke of Harkabutters or Bowemen in the Fozeuarde, & an other in the Rereuarde, in this figure aboue witten of foure score men and one, there would be. 18. Harkabutters: that is 9. in the Fozeuarde, and 9. in the Rereward: and setting two ranckes of Harkabutters in the places where y deuissions are to be made, as hereafter appeareth in figure, vnderstanding the Harkabutters by this letter H.

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H 000000000 H H 000000000 H H 000000000 H
H 000000000 H H 000000000 H H 0000 0000 H
H 000000000 H H 000000000 H H 000000000 H
  
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By those Harkabutters you maye alwayes vnderstande where the diuissions are to be made of y sayd 27. ranckes, and likewise in euery other greater number. And when suche a roote cannot be deuided into thre equall partes, of necessitye there must remayne ouer one or two. Now let vs firste take for example this, where remayneth ouer one, as it should be if it were a hundred men, the roote whereof is tenne, which tenne deuided into thre, commeth to thre times thre, and one remayning ouerplus. Wherefore there muste be made tenne ranckes to march thre and thre (that is so many ranckes as the number of the roote is of) and other tenne ranckes foure & foure together, and the last. 10. ranckes also thre & thre together: as here folowing appeareth with their 20. Harkabutters or Bowemen, besides the saide hundred men.

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H 000000000 H H 000000000 H H 000000000 H
H 000000000 H H 000000000 H H 000000000 H
H 000000000 H H 000000000 H H 000000000 H
H 000000000 H H 000000000 H H 000000000 H
  
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Front.

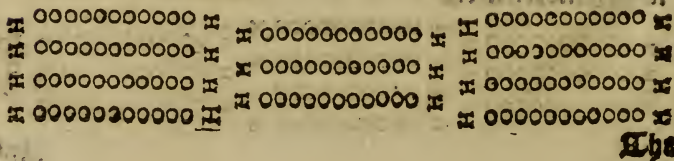
And

The ordering of Souldiers

And these three partes when it is needefull to bring them into a fowze square battaile, muste be ordered as aboue is rehearsed, or elles causing the first parte in the fowze warde to staye, and so make the second part to procede onwarde untill the heade or fronte of the seconde parte come to be even with the headde of the first, and so the saide seconde part standing still, to cause also y third parte to procede fowze warde after the same maner, the which thing being done, such a battaile shalbe broughte into fashion fowze square, with their Markabutters or Bowemen besoze & behind: as appeareth by this figure.



But when in deviding the sayde roote there shall happen to remaine. 2. ouerplus, as should be when there were .121. the roote whereof is. 11. whiche. 11. perving into. 3. comes to. 3. times. 3. and two remayning ouerplus (as I haue sayde) in this case and in other like, I woulde make a. 11. ranckes to marche (that is, as many as the roote containes). 4. menne in a rancke, and an other. 11. ranckes. 3. menne together in a rancke, and the other. 11. ranckes also. 4. menne to a rancke: As hereafter appeareth in figure, with their. 22. Markabutters, beside the saide. 121. menne.



The whiche men alwayes, when they woulde be brought into a fowresquare battell, muste be ordered as befoze is declared.

And this rule may serue likewyse in what littell or greate number so euer it be, as well quadzante as not quadzante. As for example onely in wordes: put the case that there be. 3969. whereof being minded to know how many me in a ranke shold be caused to march together by the waye, so that commodiously they maye at a soden, be brought into a fowresquare battell, then must be taken the quadzante roote of this number of menne (by the same waye that I haue taughte) whiche shall be founde to be .63. so that on euery side of the square battell shall be. 63. ranckes of menne, and for as muche as this roote (whiche is .63) maye be deuided into .3. equall partes, the thirde parte thereof is to be taken (for a generall rule) that is. 21. and therefore 21. menne in a ranke woulde be made to marche together by the waye. And alwaies there shall be as many ranckes in all after. 21. to a ranke, as are thre times so manye as the roote is of, whiche is, thre times. 63. whiche comes to 189. so that. 189. ranckes of men shall be the number thereof after. 21. to a ranke. And by the roote that is. 63. you may vnderstande that suche deuision is to be made betwene. 63. and. 63. so y the firste shall be as well. 63. part as also the seconde and the thirde. In whiche deuisions the two double ranckes of Harkabutters are to be placed for the redier knowledge to bring them into a square battell. But if in deuiding the roote into thre, there shoulde remayne .1. ouerplus, as shoulde happen if the presupposed men were. 5776. the roote whereof being 76. whiche roote deuided into. 3. shall come vnto. 25. and one to remayne ouerplus. Nowe I saye, that all the ranckes that riseth of these men, shall be notwithstanding thre times so manye as the roote, that is thre times. 76. which makes. 228. And for as muche as all

The ordering of souldiours

these orders of ranckes , are deuided euermore into .3. partes (as before hath bene declared). 76. ranckes to a parte (that is so many as the roote is of) therefore it is to be vnderstande, that the firste and the laste of these thre partes muste be made to marche .25. men in a rancke, whiche is vs muche as is the thirde parte of the roote, and for that there remaineth one ouerplus (as aboue appeareth) I saye that the same one muste be put alwaies in the seconde parte, whiche is in the middelle. I meane causing those of the saide seconde parte , to marche .26. menne in a rancke, so that the firste and the last part of the greate rewe of ranckes, be .25. men in a rancke, and the second parte to be .26. men in a rancke, and the very same ought to be done of euery other roote that may be deuided into thre. where onely remaineth ouerplus one but when there remaineth the ouerplus .2. it followeth, cleane contrary: For that the firste and the laste parte would be of one man more, then the same that y third part of the roote is of. As for example if the saide men were 2809. the roote whereof is .53. whiche deuided into thre, comes to .71. and .2. remayning ouerplus : therefore of so many menne, there shall be made .159. ranckes (that is thre times .53.) whiche .159. ranckes deuiding them also into thre partes commeth vnto .53. to a parte, that is the number of the roote. And the firste and thirde parte would be of one man more then the thirde parte of the roote, that is, it would be of .18. menne to a rancke, and the seconde parte, whiche is the parte in the middell, would be the verye thirde parte of the roote : that is, 17. menne to a rancke, so that of all the .159. ranckes, as wel the first .53. ranckes, as likewise the last .53. ranckes oughte to be of .18. men to a rancke, and the .53. ranckes in the middelle would be onely of .17. men to a rancke. And, wherein parting the roote into .3. there remaineth the ouerplus onely one, it goeth cleane contrarye to this. For that the firste and the thirde parte of the saide

sayde great rew of ranckes, will allwaies be of as many men to a rancke as shalbe the whole thirde parte of the roote, and the middle parte, whiche is the second, will bee of one man moze then the thirde parte of the roote. And soz as muche, as there can neuer remayne ouerplus aboue one or two in deuiding the roote into thre, therfoze this foresayde rule shall serue in what number of men so euer it bee, as well Quadzante as not Quadzante, soz that like as besoze is sayde in numbers not Quadzante, alwayes there is taken the roote whiche goeth nérest to suche a number, and therewith to do accordingly, as aboue hath bene sayed. And as soz the residue of the men that cometh to be ouerplus of the Quadzante of such a roote, maye be placed some other where as shall be thoughte mosse beste. For example if there were foure thousande men, which number is not Quadzante, yet notwithstanding of the same number there oughte to be taken oute the nérest roote therof, whiche is *lxxiii*. so that there shall remayne ouerplus one and thirtie men, whonie minding in a suddaine to bzing into a fouresquare battayle, there oughte to be putte in a rancke. *lxxiii*. men, and suche a battayle shall come to bee fower square, as in the beginning hath bene sayde: and where there remaynes ouerplus those. *31*. men, the Sergiant may place the as he shal thinke good. Like wise minding to cause those *4000*. men to marche, there ought also to be taken the nérest roote therof, which as aforesayde, is. *63*. which deuiding into thre, comes vnto thre times *21*. & nothing remayning ouerplus. And therfore the sayde men ought to bee caused to marche. *xxi*. in a rancke, & the sayde rancke to be deuided into thre parts. *lxxiii*. to a rancke according to the foresayde rule, in suche sorte that the last parte shalbe. *64*. ranckes, and also. *10*. men moze because of those. *31*. men that were ouerplus in the beginning, the whiche as hath bene sayde remayned oute of the araye: And after the same maner,

The ordering of Souldiours

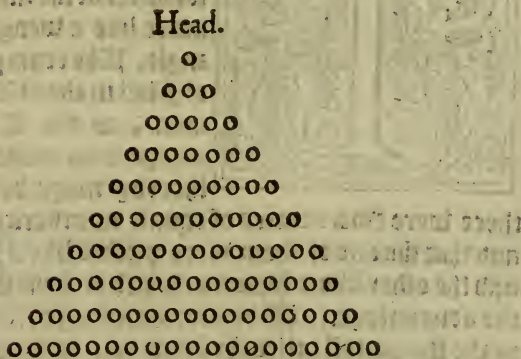
it is to be done when the rote of such a number that is not quadzante, doth not agré with the perfecte deuision by thre, which is, if there be ouerplus one, to procede as aboue hath bene declared. I meane to put a man moze in a rancke to the middell parte, and to the other two partes, the first, and the third, to put onely so many men in a rancke, as the thirde parte of the rote shal containe, and when there remaineth ouerplus two, to procede cleane contrary: that is, to put a man moze in a rancke to the firste, and to the thirde parte, and to the seconde, to put onely so many men in a rancke as the thirde parte of the rote shall be of, and those men that are remaining ouerplus, in taking out the rote in the beginning, to place them as aboue I haue saide.

¶ Howe to ordayne a number of men or an armie into a battayle, like vnto a wedge, or three square, so that it maye be apte to marche with the poynte thereof towards the enemies. Cap. 3.



This fashion of battayle, is made after this maner, first placing one man, and after thre, and nexte fise, and after seuen, and then .9. after a .11. & so to increase alwaies two men moze, till suche time as there be no moze men to place. Albeit there maye be such a number of men, that at the last they can not, or there shall not be sufficient to make vp the last rancke, which hapning, those men may be left out of the aray to serue wher their captain shal thinke most meete, for y the like hapneth often times, and in euerye maner of ordering men, that alwayes there resteth some man out of the aray. And for the better vnderstanding hereof: admit for example that the men that is to be brought into a thre square

square battaile bee a. 100. I saye that firſte one is to bee placed, after. 3. after 5, after. 7. after. 9. after. 11. and ſo to pꝛoceade: adding alwayes two men moze in a rancke, untill they bee all placed, as here following appeareth in figure. Where the laſt rancke in this caſe, ſhall come to bee 19. men, not remayning anye man ouerplus: and this is, for that the number of men, (whiche is. 100.) is a Quadꝛante number: and likewise in euery other number that is Quadꝛante, the ſayde Triangle battaile ſhall bee made withoute any man remayning ouerplus.



But if the ſayde number of men bee not a quadꝛante number alwayes there ſhall remayne ouerplus ſo many men, as the ſayde number of men ſhall bee moze then the great quadꝛant number contained of the ſame: as for example, if the preſuppoſed men to make the three ſquare battell were. 120. I ſaye that there ſhall remayne ouerplus. 20. men oue of the aray of the three ſquare, that is ſo manye as the. 120. excedeth. 100. (being the greater Quadꝛante number containd in the ſame) whiche alſo ſhall bee. 20. but if the ſayde men were. 123. there ſhoulde remayne ouerplus only two men, for as muche as the greateſt quadꝛant number

The ordering of Souldiours

ber that can be taken of 123. shall be 121. and 123. is more then the saide 121. by the saide two, and the verye same is to be vnderstand in every greate number.

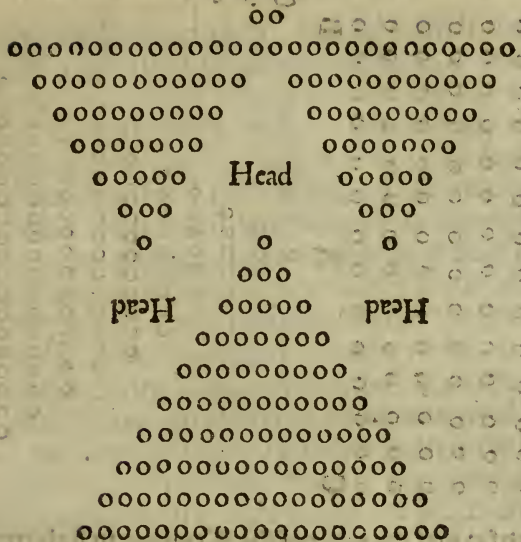
To make the battell called the sheeres, whiche in olde time they vsed to set against the Triangle.

Cap. 4.



He Sheeres are made with two Triangles ioyned together, for to receiue betwene them the saide battell, made like a wedge or Triangle. The example whereof I wil make also with 100. men, as the Triangle or wedge was made, so that thereby maye be iudged if

there were two armies of equall numbers of menne, and that the one of them were pitched like a Triangle, and the other like a Sheeres, which of them should haue the aduantage. Wherefore minding of 100. men to make the battell called the Sheeres, they oughte to be deuided into two equall partes, and of euerye one of these partes being 50. to make a Triangle according to the maner aboue declared, and to ioigne them together, as here folowing appeareth in figure with their pointes towarde the enemies: I meane towarde the wedge, to receiue it betwene them: And it is to be noted how in making of these two Triangles, there shall remaine ouerplus one man of euery one of them out of the araye, for that the number of 50. is no Quadrant number, and it is more then the Quadrate number contained of the same (whiche is 46. by a man onely) so that betwene them bothe, there shall remaine ouerplus two men, as here appeareth in Figure.



What auantage it is to order men in a Tri-
angle battaile against the enemy that knoweth
not how to make the battaile called the Shree-
res to set against it, inespacially where there is
as many men of the one part as of the other.

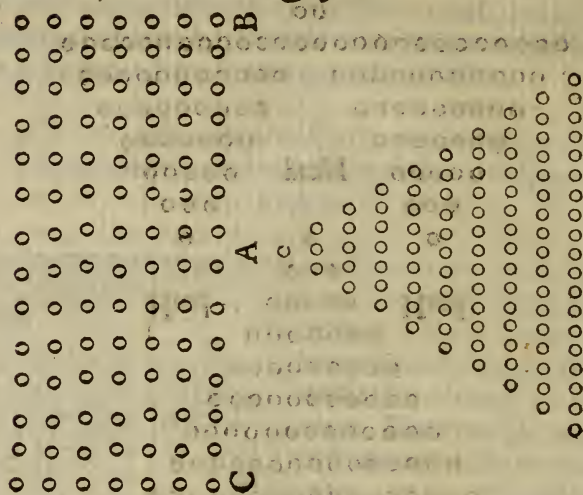
Cap.5.



When the contrarie parte woulde come a-
gainst a thre square battayle, with a bat-
tayle that were fouresquare, as now we a-
dayes is vsed, by all reason it shalbe bro-
ken and ouerthrowne. As admit for ex-
ample that there bee 100. in a thre square battayle, & a
hundred other men in a fouresquare battaile, pitched a-
gainst y^e iii. square, as here folow (ing appeareth in figure.

And

The ordering of souldiours



And for that the order of the Triangle in fighting, is after suche sorte, that all those whiche shote with anye kinde of weapon, as peeces of Ordnance, Harkebuttes, Dartes, Bowes, or Crosbowes, oughte all to directe their shotte, and to strike only in the same place, where the pointe of the Triangle seekes to enter, I meane in in the pointe A. Whereby the men that are in the same place, shall either bee slayne or else constrained to geue place to the pointe of the sayde Triangle throughe the great multitude of shotte striking in that place. So that the pointe of the sayde Triangle entering therein, maye continually penetrate al the sayde aray cleane through. For as much as all the Harkebutters, & Archers which remayne without, must not cease to shote in the verie same place, & no other where else: whiche thing doing it is impossible but that waye shall bee given for the sayde Triangle to enter in, and once entred, suche an armye is ouerthowen without anye remedye. For all the force and strenght of suche a Triangle being made

made in that place onely , it is not possible that men in
suche a place may be able to withstand, although there
were many moze in suche Quadzante aray, then those
that be in the saide Triangle, because the place of. A.
cannot be succoured of any of those of the same battell,
considering that if those which are placed towarde. B.
or elles towarde. C. would come to succour the place
where the violence and force is made, it must needes be,
that they must disorder them selues: and being once dis-
ordered, they runne into the very same mischiese, after
suche sorte, that they shall remaine altogether broken:
and remaining in their places, their strength or power,
resteth of none effecte: for as much as none of them can
be able to do any thing, howe valiaunte soeuer he be.
Whereby may be vnderstode of what importance this
Triangle battell is againste the enemye, that knowethe
not the medecin or remedy thereof.

To bring a number of men or an armie, into a batell,
which in olde time was called a Sawe.

Cap.6.



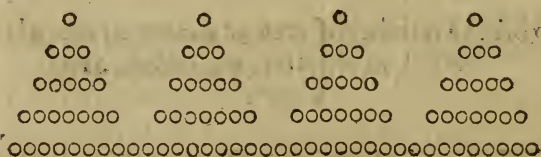
This fashio of Battel according to the qua-
litye of the name , oughte to bee made
as it were with teethe, like vnto a Sawe
whiche they vse to Sawe timber with-
all. And therefore minding to bying a
number of men, or an armie into suche a fashio, there
muste be considered two thinges, the one, howe ma-
ny teethe, this Sawe is to be made of, and whether be-
sides those teethe, there would be anye other raies to
sustaine suche teethe or no. As for example, admit that
the men of whome muste be made those onely teethe of
this foresayde Sawe, be. 100. nowe these, 100. menne
oughte to be deuided into the number of the teethe that
this Saw shall haue, and of euery of one those parts,

C.

to

The ordering of Souldiers

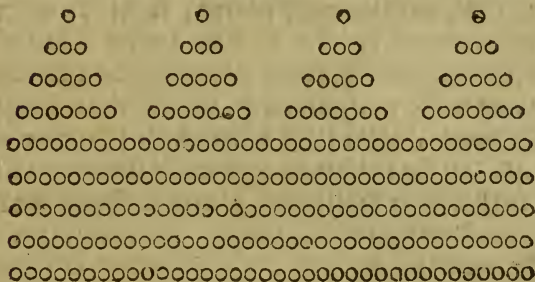
to fashion a Triangle, by the Rule declared in the thirde Chapter: and those Triangles to ioyne close together, according as was done of those two that made the Shéres: As put case that of the sayde hundred men there woulde be made foure téth of a Saue, then the sayde 100. men muste bee deuided in to foure partes, in whiche deuisions it will come to 25. for a parte. Nowe of euery one of these partes, there ought to be fashioned a Triangle, according to the order genen in the forsaide thirde Chapter. And these foure Triangles to ioyne them straight together, as here following appeareth in figure: and this is in as much as in making the téth onelye; but if peraduenture there woulde be put an other order behinde the sayde foure téth, it is needefull firste to determine of how many men such a raze is to be made, and those to take oute by them selues, and of the rest to



make the téth, and behinde the sayde téth to place those number of men whiche first were taken oute, and to ordayne them so manye men in a rancke, as shall bee founde directlye in length in all the hinder partes of the téth that are made, as for example, admitte there bee two hundred & xliii. men, and that with a hundred men therof, there must be made foure téth of a Saue, & the other 144. to be made certayne ranches to sustayne the sayde foure téth: Wherefore the hundred men being broughte into foure téth, as aboue is declared, consequently behinde those, there oughte to bee placed those C. & xliiii. men. xxvii. mē to a ranke: for as much as in all the foure lower partes of the sayde foure téth there

there bee 36. men as in the figure nexte following appeareth. And after this maner and order, if there were a hundred thousande men, they mighte bee set in a raye, placing them, as aboue is done with that litle number.

Front.



To fashion a battayle of a number of men or an armie like vnto twoo Triangles ioyned together, so that they may bee apte to marche with a corner therof towarde the enemies.

Cap. 7.



With the rule whereby the single Triangle is made, with the verie same almost this fashion battayle is also made: for as muche as deviding all those men, or that Armye wherewith this fashion battayle is made into two equall partes, and of the one halfe thereof to make a Triangle, and that done, vpon the very last side of the same, there ought to be placed the other halfe number of men in ranches, which continually go decreasing by two men lesse, I meane cleane contrary to y was done at y beginning with one, where beginning to make the pointe of the Triangle the ranches were continually increased with two men moze. But it is to be vnderstande, that if in making the first Triangle, there happen

Cy.

to

The ordering of Souldiers

to remaine ouerplus any men , that are not sufficient to make by an other rancke , yet the very same rancke oughte to be finished by with some of the other halfe number of men, for that one of these two Triangles ioyned together , cometh to be of one rancke more then the other. As for example, admit the men, wherewith this fashion battell is to be made, be .320. which muste be deuided into two equall partes , so that by suche diuision there will be .160. men for a parte , and of the one of these partes, there woulde be made a Triangle, according to the order declared in the thirde Chapter, whiche done , there shall be founde to remaine ouerplus .16. (by the reason alledged in the saide third Chapter) so that there shall lacke .9. men to finishe the saide laste rancke of the first Triangle: Therefore the saide rancke muste be made by , with the men of the other halfe, as taking those .19. men whiche lackes, so that in the saide firste Triangle maye be .169. men, and in the other parte onelye .151. menne , wherewith the other Triangle ought to be made vpon the laste rancke of the firste, whiche laste rancke shall be of .25. men: wherfore vpon the same, there muste be placed an other rancke of two men lesse, that is .23. and vpon the same saide .23. menne, to place an other of .21. menne, and vpon the .21. menne, to place an other of .19. menne, and vpon those .19. men, to place an other of .17. men, and so to procede alwayes with two men lesse, till suche time as it cometh to the rancke of one man onely, as here folowing appeareth in figure: Trewe it is, that there shall be founde in the ende, to remaine ouerplus .7. men, the whiche the Sargiant maye place where he shall thincke good. And thus with this maner of order, there may be brought into like araye, anie armie howe greate so euer it be, and they may turne them selues, and in marching, make of the Rerewarde, the Fozewarde, and likewise of what so euer side they liste.

Front.



C.lij.

VVhat

The ordering of Souldiers

¶ What is best to be done where the ordinance of the enemies being shotte into the army hath slaine many men. Cap.8.



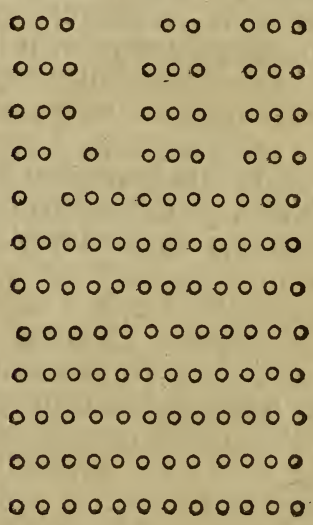
An Armye of menne that happeneth to haue certaine ranckes thereof to be stricken downe & kille with the enemies ordinance, and marching after such sorte, leauing boide the places of those menne whiche are slaine with the Artillery, or els drawing the selues close altogether, to fill such empty places, the one of these waies is very euill, and the other much worse: for as muche as leauing those places after such sort open, inespacially in the foreward, there is geuen thereby greate faciletie vnto the enemies to enter into the saide raies, and to ouerthrowe them. And likewise causing after such misfortune y^e saide raies to draw together, to fill the saide places, those raies must needs altogether be disordered, and shall bee brought almoste into confusion: for y^e it is to be thoughte that the saide artillery, dothe not destroye any rancke of menne wholye from one ende to an other in lengthe, but onelye a parte of some, and a parte of other, and some to remaine vntouched, or unhurte. In whiche case being minded to cause them to drawe together, to fill by the sayde boide places, it muste needs followe that the whole rancke do disordered in lengthing those that lacke, so that some of the ranckes shall remaine withe a greater number of ranckes of menne (in length) in the Rearwarde, then in the Forewarde, whereby if such a battell woulde marche of necessity it will immediatlye run into confusion, because of those ranckes that are vnperfecte in lengthe, Wherefore that Capitaine, is to bee praised, whiche instructeth his menne that in like chaunces, they neuer remaine withoute a compaignion befoze them, excepte it be in the Fronte, as to aduertise

uertise euery one of them , that if it fortune to happen
anye of them to lacke the same man , whiche was
wonte to marche befoze them , o2 elles mo , that then
incontinente , and with seleretrie they do marche foꝝ
warde , vntill they finde an other companion in the
accustomed distaunce befoze them , and where it fortu-
nethe no man to be founde , to aduertise them , howe
they shoulde then procede till they come to the head o2
Fronte, and in such place to stand still, o2 elles to march
according as the other ranckes in the headde o2 in the
Fronte shall do. And this being a generall rule
that euerye man muste take the measure of his mar-
chyng softelye o2 faste of his compaignions that goeth
befoze him, and not of anye that be of theyꝝ sides. All
those menne therfore that shall be founde in the verpe
same rancke behinde suche a man that doeth lacke his
compaignion o2 compaignions befoze him , shall bee
constrained to runne , o2 go a pase according as that
man shall marche, whiche shall bee nexte befoze him:
whiche thing being obserued of euerye man in the bat-
tell , alwayes the ffoze warde o2 Fronte thereof, shall
come thereby to be whole and sounde , and those emp-
tie places of the deade to be transeformed into the Rere-
warde, in whiche places there shall not almoste be any
perrill. As foꝝ example, admitte, that in a battell of
144. menne in fashon fowresquare, the enemies hath
slaine .12. menne, as by the voide places in the figure
folowing appeareth, I saye that hauing aduertised
euerye man to do as muche as befoze I haue declared,
whiche is, that euerye time that he lacketh his fellowe
(o2 mo men) that marched befoze him, he do straighte
waye make haste, and withe all speede possible not to
seace going foze warde , till he finde an other compaign-
nion

The ordering of Souldiers

in the accustomed distaunce that goeth befoze him.

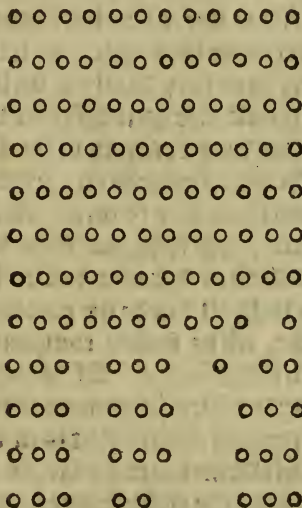
Front.



And if it fortune in suche a rancke that in the ende hee finde no man, yet he ought to proceade so muche till hee come to the last ranke in the ffront, and there to stande still, or els to marche according to the order of the saide rancke. And likewise euery man ought to take heede that in his marching falte or softelye, hee doe rule him selfe by his compaignion that goeth befoze him, and not of any of those that be on his sides: which thing

thing being obserued , as in the figured rayes aboute

Front.



written, they same battales, shal be transfoymed in this
other maner, like vnto the last figure , that is, those 12.
boide places shalbe translated into the rewarde, as plaine
lye maye be sene.

¶ How to chaunge with speede an Armie, that is, in bat-
telray fouresquare, into a triangell fashiō, without dis-
ordering the first ranckes, and without perill of
confusion. Cap. xix.

D

Like

81. *The ordering of Souldiours*



Like as the Capitaine with sounde of the Trompette, or with voyce shall cause the Souldiours to be aduertised and taughte to knowe howe to turne that waye, which is betwene the fronte and the righte side, or the lefte, and likewise that waye that is betwene the righte, or lefte side, and the backe, and after that they shall bee well informed therein, euen so I would also haue the to be well aduertised of the same, that was declared in the laste chapter, whiche is to shewe and teache euery man, that all wayes when he shall be caused to turne towarde anye of the foresaide sides, and shall not finde to haue his fellowe in the accustomed distance before him, that then the same man with all speede doe procede, or march so farre righte forth, till he finde a companion before him in the accustomed distance: Of whiche thing euery souldiour being well informed and instructed, with the twinkling of an eye, an Armie that is in fashion. liij. square, may be transformed into a triangle. As for example, minding to make the right corner & point of the sayd triangle, with sounde of Trompette, or with voice, causing euery man in the armie to turne them selues with theyr faces that waite, which is betwene the front and the righte flank, and incontinente, so soone as they are turned, euery man obseruing the foresayd order, that is, that all those, whiche shall perceyue not to haue his fellowe before him in the accustomed distance, doe procede straighte forth untill he haue one, whiche done, the saide folwe square fashion, shalbe founde to be changed into a triangle fashion, and the pointe of the same triangle figure, shall come to be the righte corner of the fronte of the firste figure. Whiche thing is as easie to be done as is possible: for the triall whereof, let there be for example. 25. men standing in fashion folwe square, as hereafter appeareth in figure, and to cause

cause it to be better vnderstande, I haue thought good to make this figure with the 25. letters of the a b c. Now minding to chaunge this foure square figure, into a triangel figure. It is needefull to cause the all to tourne

Front.

A B C D E

F G H I K

L M N O P

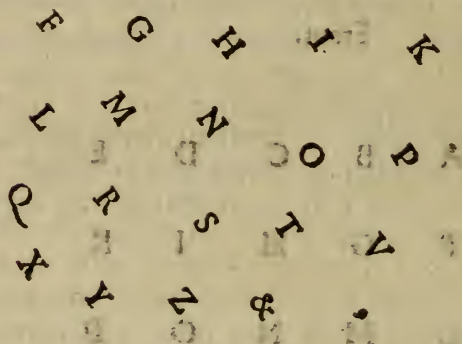
Q R S T V

X Y Z &

with their faces that waye, whiche is betwene the head and the same side, where I haue thought good to make the point of the wedge or triangle: as for example purposing to make the corner. E. the pointe and head of the triangle, I shal cause that euery man do tourne with his face that waye, betwene the front & the righte flank, towardes the corner. E. whiche thing done, the foresayde figure shall come to stande as here appeareth: in whiche figure maye bee seene manye men, that hath no fellowe in the accustome distance befoze him, although they haue a selow straight befoze him, much moze further

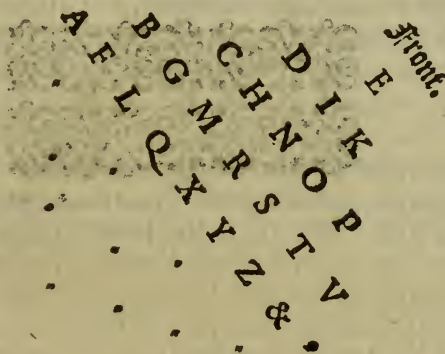
The ordering of Soudiours

From.



ther of them the ordinarie, whiche is double so muche as the ordinarie, as appeareth by .F. who hath righte befoze him .B. but the distaunce that is betwene the sayde .F. and the saide .B. is double so muche as the ordinarie distaunse, wherefoze if .F. shall obserue the preceptes aboue declared, immediately so sone as he shall haue turned his face that waye, he shoulde incontinent go, to come nērer to the saide .B. in the accustomed distaunce, whiche doing, he shall bring him selfe betwene .A. and .G. Albeit the saide .G. shall not remaine in his firste place, but shall go nērer vnto .C. to the accustomed distaunce, and in the place where .G. was firste .L. muste come. So that .F. shall stande betwene .A. and .L. and likewise if all the other shall procede forward, according to the saide order, vntill enery man finde a fellowe in the accustomed distaunce befoze him .H. shall go nērer vnto .D. and .M. shall followe the saide .H. and .Q. shall followe after the saide .M. enery one of them, vntill they come to theyr accustomed distaunce

staunce. And in like maner, I. shall go néere vnto, E. and N. shall followe, I. and, R. shall followe, N. and, X. shall followe the sayde. R. every one of them vntill they come to their accustomed distaunce. Likewise, O. shall go néerer to, K. and, S. shall followe, O. and, Y. shall followe, S. also to the ordinary distaunce: and likewise, &. shall also go néerer to, V. to the accustomed distaunce, which thing being obserued, such a foure square battel shall be transformed into a triangle battell, as here following appeareth in figure, the point whereof shall come to bee the corner. E. and with this order a Capitaine may chaunge an armie, with turning of a hande, though it were of 100000. men from the fashion of a foure square to the fashion of the square. So that the sayde men be aduer-



tised and taughte, as afoze hath bene declared, both as well to knowe howe they oughte to tourne as to marche

21. The ordering of souldiours.

che. Whiche is of wonderfull importaunce: for as much,
as at a sudden to reduce an armie after this sorte into
a triangel fashion, it is almoste impossible that the ene-
mies shalbe able, or shall knowe how to make their ar-
mie like the Sheres to set against it, wherby shal come
great aduantage as by the x. chapiter above is plain-
lye proued: for that it seemes vnto mee that a triangle
battayle, maye be alwaye sufficient able to breake all
maner of fouresquare battayles as is vsed now a daies,
although it had halfe so many more men, so long as those
of the triangel battel be well instructed of the
maner of their fighting declared in the v. chapiter.
chapiter.



¶ Of the perfecte forme or fashion of all good strong places.



He forme which vnto the circular fashion doth moſte reſemble, of experthe and ſkilfull ſouldiours, is aboue all other with moſt reaſon praiſed, ſo y the Curtine oz walles therof, be made ſtraight, and of ſuch length, that of the bulwarkes they may be ſtacked: whiche fashion being

made with manye corners, is verie meete and neceſſarye if in a ſufficient great place it bee erected: for where in ſmall roomes the iuſte length of the courtin is ſhortened, it is conuenient to buylde them with fewe corners, becauſe if otherwiſe they ſhoulde bee ſhortened with a number of corners, the ſhorter of neceſſity the ſpaces betwene thoſe muſte bee, ſo that beſides that thone bulwarke maye hurte the other, they ſhalbe moze conuer to no purpoſe, but rather an occaſion of infinite coſte, their courtins needing as is requiſit to be defended of platfoymes, and the corners therof ſhall come to bee leſſe blunt, and muche ſharper then they oughte to be, by reaſon of the litle diſtaunce betwene them and the platfoymes. Wherefore the moze that they be made diſtaunte from thoſe bulwarkes (the due length of the curtin being kept) ſo much the blunter the corners will come to bee, which by them muſt be defended, and the moze of thoſe corners that there are in the ſame fashion, ſo muche the blunter they ſhall alſo come to bee. So that where the fashion of the places that are builded bee ſufficiente great to contayne all the foreſayde particulars, whiche for a ſure ſortreſſe is requiſite to bee made, all thing commodiouſly will come to paſſe: and the greater that they

plattes

they shalbe, the moze men they maye haue to defend them and moze commodious space within, for to retire with greate and strong fortification, and the platfozmes maye be made muche further in, and haue the coznerns of theyr bulwarkes blunt, and with a large backe, meete for defence, and in an assaulte, muche surer then the sharpe, because the sharpe pointed bulwarke, being battered defendeth the enemye from the platfozmes, so that vnder the same, being couered, he maye almost oute of daunger, make an assaulte. Where against a Towne or Fortresse, that were builde after the fashion of these plattes folowing, in what so euer parte of such places, the enemy should appoche marching towardea them to incampe, or in battell raie to assaulte them, or with Trenches, and artillery to batter them, either high or lowe or by the curtin within, or other wise, he shall alwaies, from many of those flankers of the same place, be greatly hurte and repulced, and of the platfozmes in especially, moze then from any other where, because they be mozte nere, and stande higher then all the other, and they shall also hurte him moze, when he shall bee somewhat farre of, then nere hande, as maye be sene by the plaine platte that hath the number .1. and in the same that is raised vp, that hath the number .2.

The whiche with two other are also here after pictured, to the ende that thereby maye be considered of such as shall see them, the sundrye good and notable effectes that bee in them, the whiche althoughe it bee not possible so easelye with wryting to bee expressed, yet by theyr helpe they maye be better vnderstande and comprehended, and mozeouer by them shalbe gotten this knowledge, whereby euery man commodiously maye vnderstande, where the enemye going aboute with his power, maye best deuise to assaile them, and howe they within maye prouide to defende and withstand the same with theyr men, taking them from those places
wher

where they may best be spared, so y^e building the fashioⁿ of fortresses, in the saide maner, there shall in no place happen any such incommodities, as in other that are igno^rantly made, after the ordinary fashioⁿ with lesse co^rners, as also by these figures, here folowing is moze plainly declared.

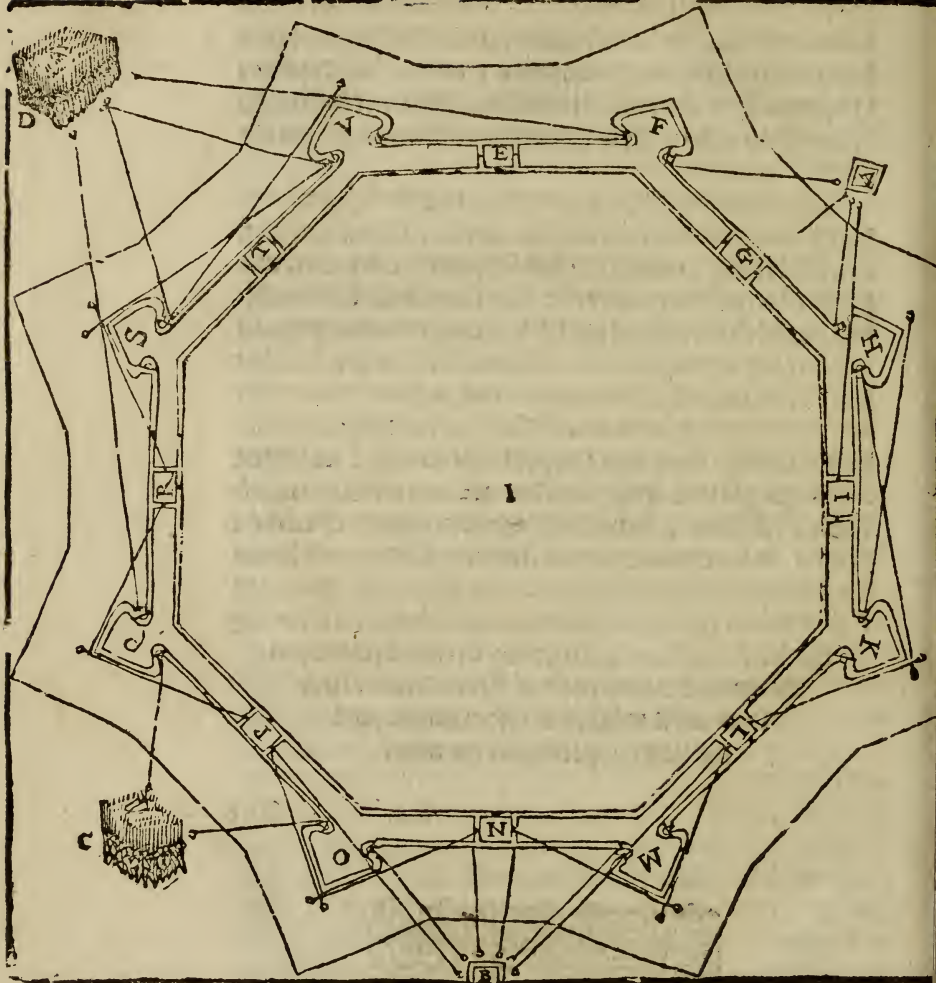
There oughte also to be noted, that these and the other plattes, in this treatise set forth, being drawen in a litle space, could not be fashioned with their due proportion: albeit to the ende that same which is reasoned about them, might partly be vnderstande, they are not left out or omitted: for without their help it should be haue bene impossible for anye man, to haue comprehended that, which I seeke to declare, concerning fortification. although they were expert souldiours: as by the foresayde plattes of the nomb^re of 1. and 2. maye manifestly be seene, howe well the courteynes of suche a towne, is by the bulwarkes therof defended, and howe the ditches of the platfo^rmes, and of both of them are flanked and skowzed, besides other thinges, whiche by the lines that are drawen be declared, where otherwise it could not be shewed after such sorte, as it might be vnderstande, and the like happeneth in the other.

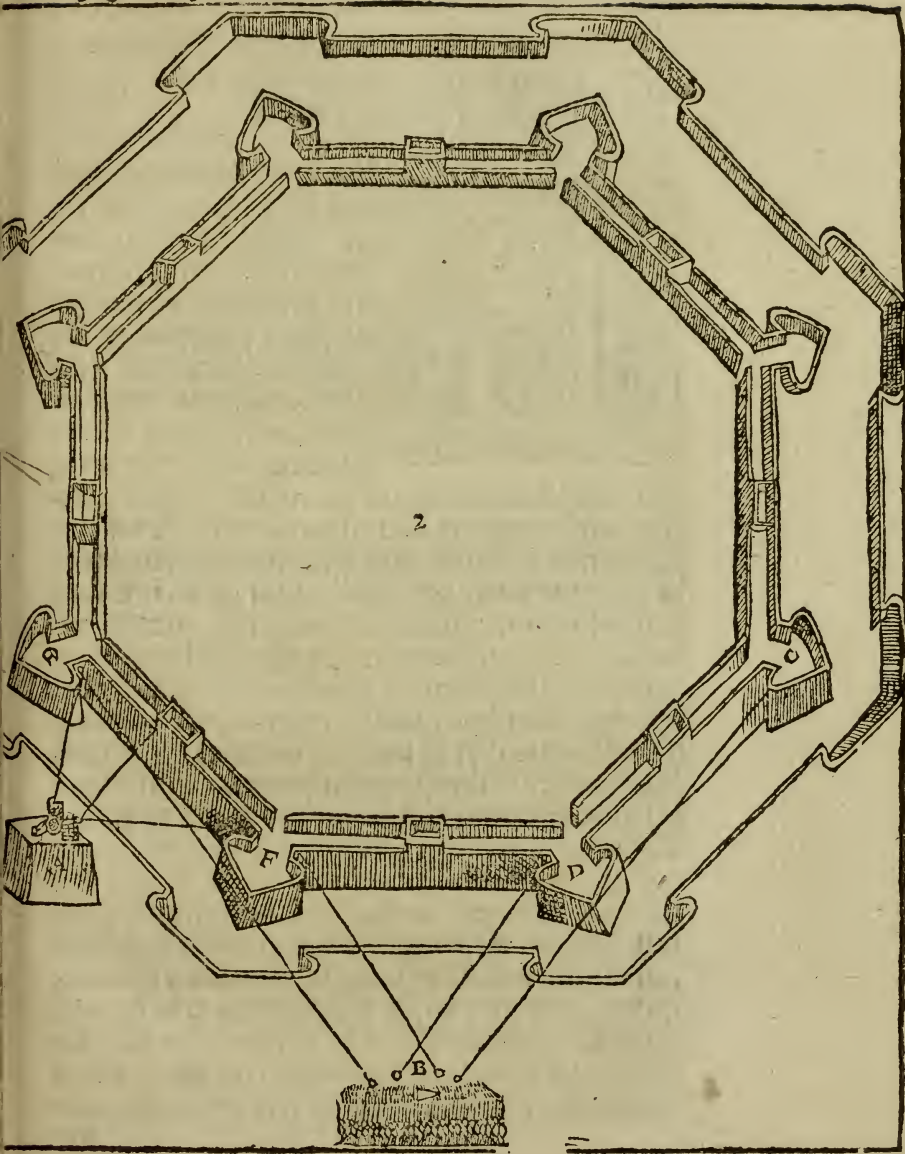
C.i.

The



Plattes





Plattes

The strongest and perfectest fashion of all other
for the building of the cortin or vvall
of a Tovyne or fortresse,



Efore being shevved concer-
ning the perfection that for
the fashion of Fortresses
is requisite, howe thy oughte
to be buylded with a nombꝛ
of coꝛners pꝛoportioꝛned ne-
uerthelesse, with a iust lēgth
of the coꝛtin, and a sufficient
distaunce betwēne euerye
bulwarke, so that the moze

that with like conditions to the circular fashion it re-
sembleth, so much the moze it becommeth perfect.

Where now remained to be cōsidered, what fashiō is to
be iudged of mosste perfection, either the same whiche
without any edification placed in the middelt of the coꝛ-
tin therof, shalbe builded, oꝛ that which shal haue either
caualiers, oꝛ platfoꝛmes, oꝛ what so euer other maner
of edification oꝛ figure, that for to defende the coꝛtins of
the bulwarke may be placed: oꝛ whether it be of those
fashiōs, which vnto this present hath bene vsed of other
in buylding, oꝛ some new maner that might be deuised
Therefore in this part leauing to reason of those, that
shall haue caualiers oꝛ platfoꝛmes as also of those bul-
warke that the coꝛtins shall haue, which from the one
to the other mosste straightlye without other edification
placed in the middelt do shote, for this time I shall only
shewe a newe fashion, the which I iudge to be the most
perfectest, that is possible to be imagined, as maye bee
sene by the lines y are drawen from the plaine plat of
y nūber of 3.4 by the plat that is raised vp of the nom-
ber

ber of .4. here vnder figured, which resembling so nere the circular figure, as the due length of the curtain will suffer, they shal haue this difference frō the other which directly are dissended, that the cortin being made backe a conueniente distaunce, that space maye be leste mete to make from the one and the other pointe of the same retire, a flanker, as two like flankers maye be sēne, in the plaine platte of the number of. 3. by the letters .E. and .F. and in the platte that is rayled vp of the number of. 4. by the letters, A. and. C. they shall haue commoditie to directe their ordinaunce to flanke, as well highe as lowe, like vnto those that are commonly builte nowe a dayes: whereby, not onely the same space of the curtain, that is betwene the one and the other of them shalbe perfectlye defended, as maye be perceyued by the platte of the number of. 3. by the line drawen from the letter .E. to the letter. F. but also that whiche lieth betwē them and the bullwarkes, as in the saide platte, by the lines that describeth the manner of the shotte the one from the letter. E. to the letter. S. the other from the letter. F. to the letter. R. maye be vnderstand, and likewise the curteines of those bullwarkes, as also in the verry same, by the line that is drawne from the letter. F. to the letter. Q. is shewed, with a better maner than in other fashion of building that is vsed can be defended, so that all the partes of them shall not onelie be made to be able to shote by flanke, but also thereby to shote by righe line, as in the platte of the number of. 4. by the line that passeth from the letter. C. to the letter. D. and from the letter A. to the letter. B. maye be perceiued. And whereas they maye be builded with lesse coste then otherwise, they haue also commoditie to make their gates equallye distant the one from the other, from the nexte bullwarkes: where they are placed moste safelie and commodiouse with greate strengthe, and those gates be as

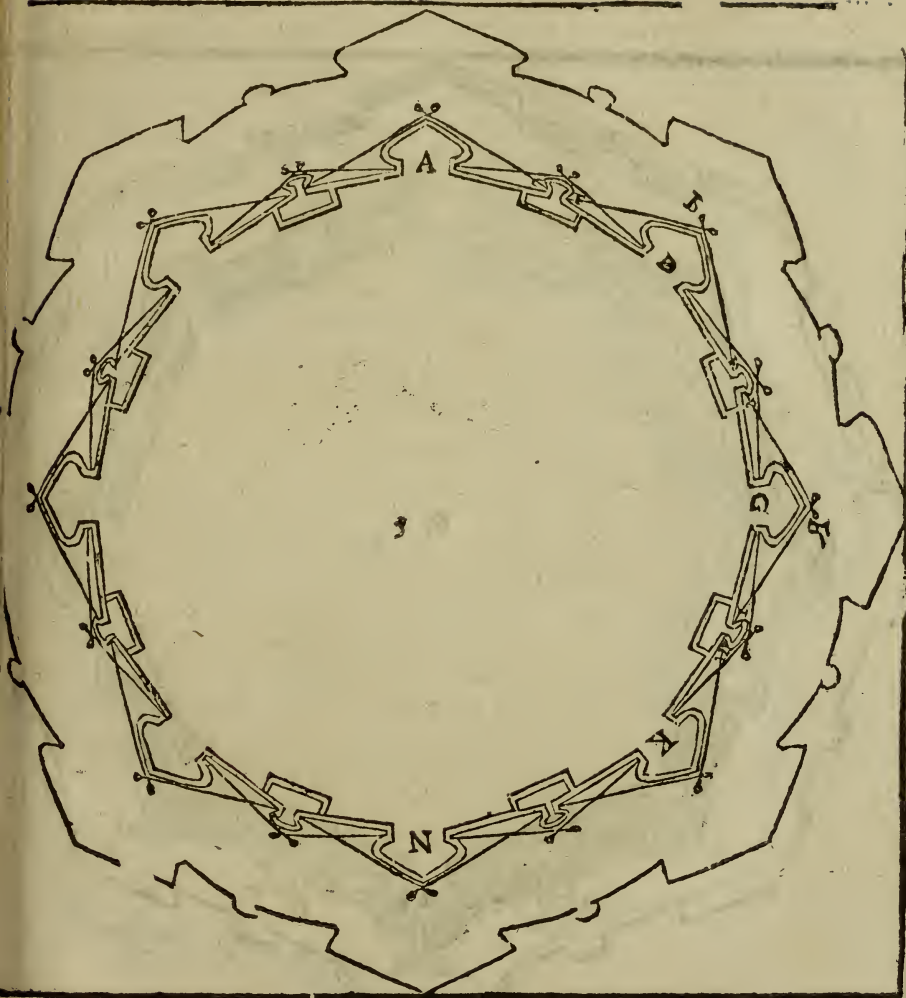
Plattes

well, as all the rest of the wall, and greatlier in that parte, much surer from the assailing of the enemies, then in what so euer other maner of fashion mighte be deuised: for as muche as the platfozms, and caualiers bee nothing so strong, but moze easie to bee ouerthrowen, in respecte to this maner of building, which is moste sure from such daunger, and exceedingly well defended from the force of the enemye: to the which, the nerer that the enemye shall appoche, so much the moze he shall of those within be hurt, contrary to that, which in the platfozmes happeneth. Moreover there maye be certayne slaughter houses builde in the ditch, as in the plat of the number of. 4. by the letters. F. H. is shewd, which enemies with greate difficultie must firste seeke to winne, before they can come nere the walles.

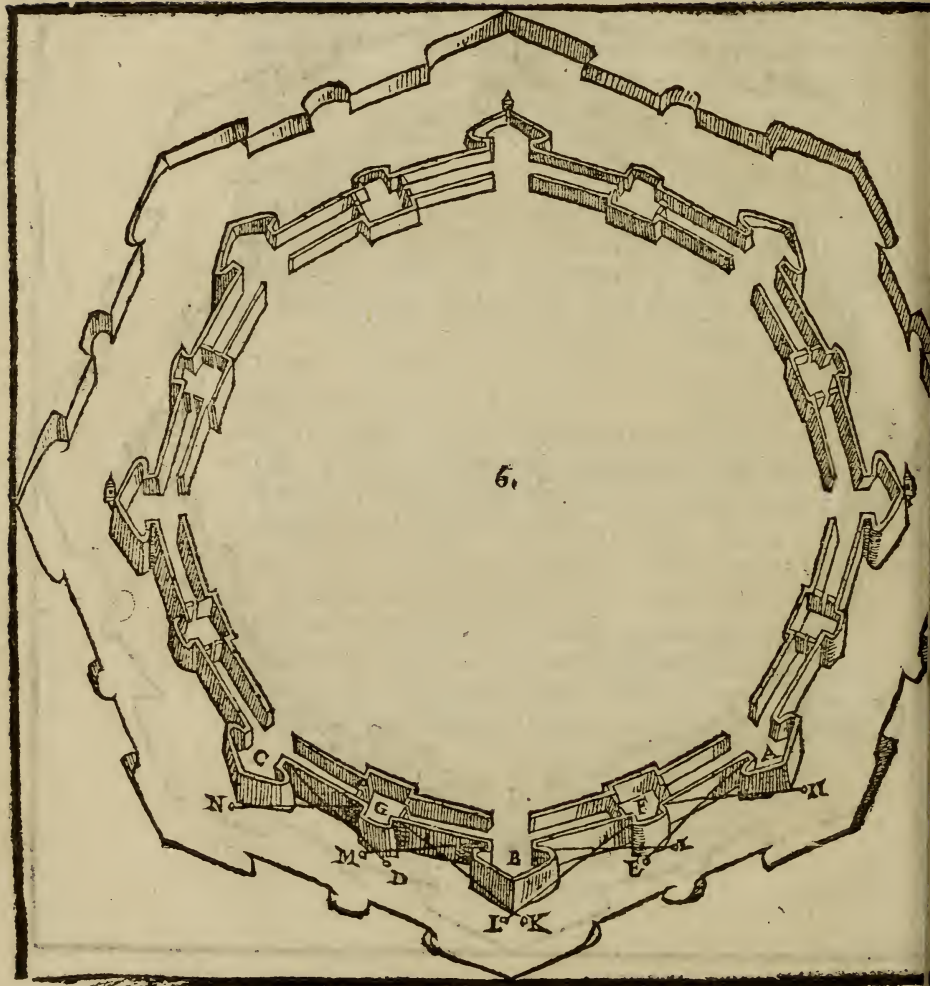
And those being wonne, shall be but small preiudice to the towne or fortresse: wherefore without comparison, this fashion is greatlier to bee praised, then the same with platfozmes for that the nerer the Wall, the enemye shall come, so much moze from the bulwarkes by flanke, and all most on the backe, and from other places, both by flanke, and by fronte in one instant, he shall be hurte and stricken.

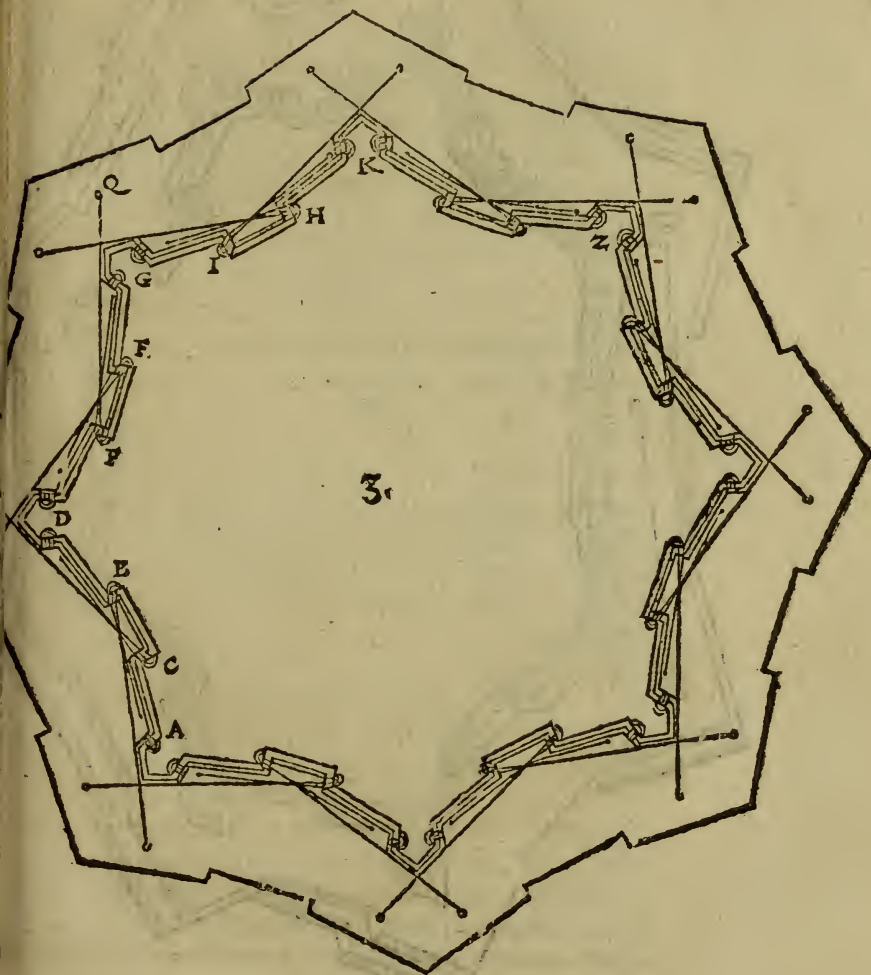
Where also in suche a kinde of fashion with many corners, the greatenes and roome of the towne within, is somewhat deminished, in respect to those that are made

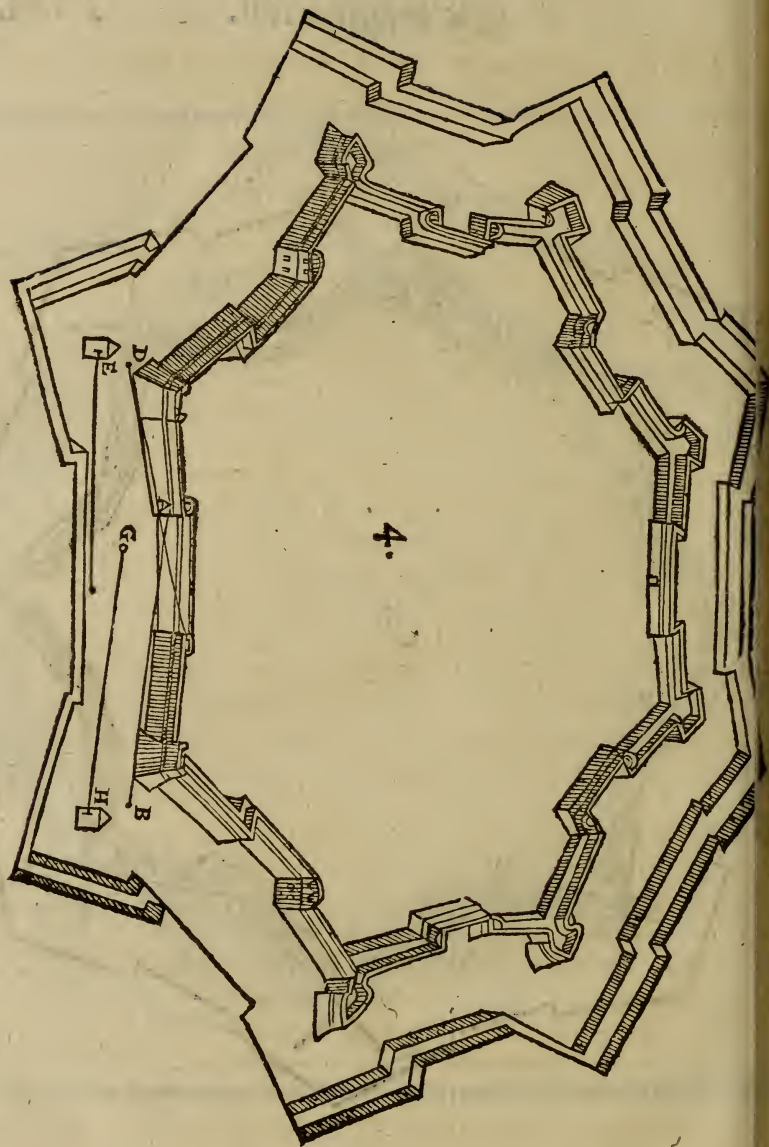
with platfozmes. Therefore I conclude, for the considerations aforesaide, these to bee the moste perfectest fashions that any strong fortresse, is possible to bee made.



Plattes







¶ An example of the quadrant forme to prooue that it causeth debilitie and vveakenesse.



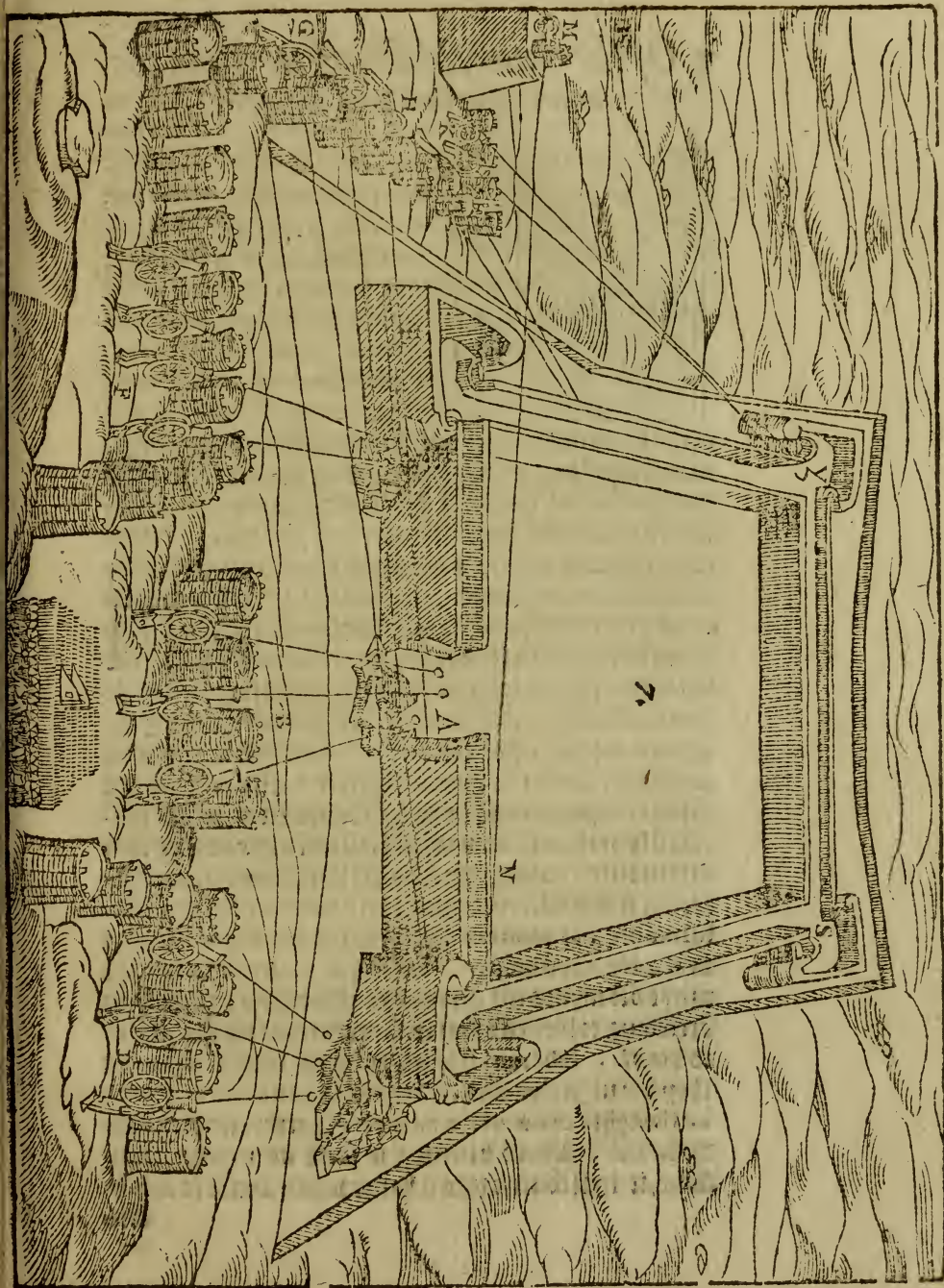
HE tovnes & fortresses that are buylded after a foure coznered fashjon , in what so euer maner they be made, are subiect to mosse great inconueniences: for that the sharpe coznerns of their bulwarke whiche of necessitie the same fashjon will cause them to haue, may very easly be bat

tered , and vnder the ruine therof, the assaultes of y^e enemies defended, as in the platte folloving of the nombze of 7. by the bulwarke C. battered of the artillerie D. is scene. Whereby also maye be perceyued how the ozdinaunce may be planted to make a bzeatche, and to take awaye their flankers after such sort, that the enemies maye safelye appoche to anye place, either marching in battelray to incampe, or assaulte, or with pianers to worke, or for any other purpose, as by y^e foure flankers of the thze bulwarke. L. E. C. may be vnderstande, the whiche of the artillerie. H. F. K. G. not onely are battered, but also two of them that haue the letters. L. C. as is scene, may of the artillerie. K. G. bee beaten through their flankers , & the backe of the bulwarke. E. neereff to them, which is on both sides of the flankes battered, the whiche for hauing in such place lesse thickenesse then anye where els, and great heigth, maye bee the moze easelier ruinated. as is to bee scene in the sayde bulwarke. E. battered with the artillerie F. and. H. and also by the bzeatche of the batterye , whiche in the coztin is made of the ozdinaunce B. as is scene where the artillerie G. by the coztin doth beate through the same in y^e bzeatch of the batterye A. as manifestly appeareth ; and moze

Plattes.

ouer when they within woulde do any thing, they shall be beaten with the artillerie ouer the wall within the coztin N. frō the caualier M. without, so that no man shalbe able to stande behinde the same to defende. And not onely in this sorte, but in sundrye wise, and in diuerse maners, what soeuer towne or forte is builded after such fashion, maye easely be battered & some made sautable, where by without further declaration it is playnly to be vnderstande, how much the foresaid plattes of the other fashion excell this.





¶ *Of the nature of Saltpeter, and the
maner howe to make and refine it.*



Alt peter is a mixture of manye substaunces, gotten out with fire and water of drie & durtie ground, or of y flower, that groweth oute of newe walles, in cellars, or of that ground which is found lose within tombes, or desolate caues, where raine can not come in: in the which ground (accozding to my iudgemente) the same is ingendered of an ayrie moistenesse drunke by, and gotten of the yearthie dzyne: whose nature (by the effect therof) considering, I cannot tell how to be resolved, to saye what thing properly it is. The well learned and most wise Philitions (besides medicinall experience) by the taste (finding it salte, and with exceeding sottill sharpenesse, and considering the great bytyng therof) suppose verelye that it is of nature hotte and drye: on the other parte, seeing it to be a thing ingendered of ayre, and touched of fyre to fall in a flame, and vapoze, and rise with a terrible violence (as the same compounded, is seene by Conpoulder moste manifestly declared) seemeth to bee of an ayrie nature, hot and moist: and againe seeing it with shining and glittering whitnesse, as a thing to the nature of water conformable, it seemeth that it maye bee sayde, that it is of a waterye nature, finding it heauye: to whiche maye bee ioyned the experience of the taste, and of the exceeding coldenesse that in somer it causeth the water to bee of, wherein it is put to keepe Wine colde, as they vse in Italye, and by the bzittelnesse therof, it may be thoughte to bee of the nature of earth: and so muche the moze, where burning it with as muche bzimstone, it will tourne into a harde white stone: so that to
con

conclude, it semeth that it hath the soueraintie & qualitie of euerie elemente. Powe this of aunciente wryters, was called nitro: and Plinie in his naturall historie in the. xxxj. booke sayeth, that it differeth not muche from salte: whose nature semes also that vnto Whisiti-
ons hath not bene hid: & it is found in manie places, but y^e best is founde Macedonia: Albeit the late wryters, specially they of our partes, say that Plinie, and the other wryters beleued that it was minerable: & peraduenture they are deceyued: soz that there is of the artificial: which hath the very same vertue, & as some thinke, moze strö-
ger of nature: & is founde soz y^e very same medicinall ef-
fect, better then the naturall. Powe this (as I haue sayde) is dyaüwen fowthe from the sayde durtie yearthe, so that y^e yearthie dzyues by raine hath not bene extinct: but the moste excellenteste of all other, is made of the dunge of beastes, conuerted into yearth, in stabells oz in dunghilles, of long time not vsed: and aboue all o-
ther, of the same that cometh of hogges, the moste and best is gotten: what so euer dunge it be of, it is requisite y^e by continuance of time it be well resolued into yerth, and the humiditie therof dzyed: yea and it is nedefull y^e the same yearthe be as it were dustie. To minde to haue a saye to knowe whether it be good, by the taste of the tong it maye be felte if it be byting, and howe muche: and finding it strong, so that you determine to worke of it (making a great quantitie) it is neces-
sarie to prouide manie Cauldrons, foznesses, barrills oz tubbes: and likewise wood, white lime, and asshes of olde oke: but chieflie muste be prouided a great barne, oz other walled house nere to the water (whereof it is nedefull to haue inoughe, as also of yearthe, both com-
modious foz the place, & likewise euery other thing.) But firste the foznesses muste be made foz the caul-
drons, and they muste be placed thereon, as those be
that

The making and refining

that the diers be: then there must be prepared ioyntes as long as the house, and so broad, that commodiouslie aboue grounde maie stande buttes with their heads knocked oute, square chestes, barrells or tubbes to the number of. 50. or. 60. or. 100. (according to the cauldernes, and the capacetic of the place) and betwene enerie tww of those vessells, there muste be set a halfe tubbe to receiue the water that shall run oute: or there woulde be placed a channell of wood that maye gwe along vnder the holes of the vessells that are set aboue grounde, so that it maye conuey all the water that comieth from them, into a greate tubbe or tww sufficiente to hold all the water ful of substance of Saltpeter: and the buttes that haue their headdes knocked oute, or barrells or tubbes, in the bottom of enerie of them there muste be made a hole on the one syde, with an Awgar, or els thre or fower littell holes made with a good bigge perfer: and vpon them muste be layde a littell thinne linnen clothe or els the ende of a brome, or some strawe, to the intende that it maie kepe the yearth vpon and straine the water that shalbe put amongeste the same yearth which is to be wrought, when it is tasted with the mouth, so that it be certaine, that it containeth Saltpeter.

Then there muste be made thereof, in the middelt of the house where it is to be wroughte, a greate hill, nexte vnto which muste be made an other halfe so bigge, which must be made with tww pares of vnsaked lime, and thre of oke ashes, or other ashes, which in taste are verie strong and sharpe: and then the one hill muste be well mingled with the other, and with the same composition, the tubbes muste be filled that are set a losse vpon the ioyntes. within a span of the mothe, or else (minding not to mingell with the yearth the ashes & the lime together) you maie put firste a spanne thicke-

nes of yearth in the bottome of the tubbe , and then
 thre fingers thicknes of the forsayde lime and asshes:
 and vpon the same after , an other spanne thicknes of
 yearthe , and on that likewyse, an other thre or foure
 fingers thicknes of lime and asshes : and so putting
 one rewe of one thing , and an other of an other , you
 shall fill all the buttes and tubbes , or other vessels
 that you haue placed , euen as aboue I haue sayde,
 wythin a spanne of the mouthes of them, and the reste
 that is then emptie , which you leste , you muste fill
 with water : the which running thzoughe all the
 yearthe , by a littell and a littell , you muste let it
 dzoppe in the tubbes that stande vnder to receyue it,
 or in the gutter or channell, or where you liste , so that
 it be conueyed into one or into sundrie tubbes, or where
 you thincke good : and so you muste see well that
 you gather all the water that you powred vpon the
 yearthe ; after it is passed thzoughe the holes of the bot-
 tom of the tubbes, in suche wyse, that it bring with it
 all the substaunce and vertue of the Saltepeter that
 was in the sayde yearth: whereof by putting some of it
 on your tongue, you maye taste: and finding it biting
 and very salte , it is a token that it is good and that
 you haue done well : if not, powre it agayne vpon the
 verye same yearthe, or vpon some other newe: but fin-
 ding the firste yearthe full of substaunce as muche as
 sufficeth, you maye agayne powre vpon it moze water,
 to washe better the remnaunte of the yearth: albeit
 this seconde water woulde be saued in an other vessell,
 and after this, the yearth maye likewise be washed the
 thirde time, to thintente that all the substaunce there-
 of, maye perfectlie be gotten : but this seconde nor the
 thirde , ought not to be mingled with the firste, if it
 happen not to come of the verie same taste: the whiche
 I beleue that it will not : but it must be put by it selfe
 in other vessels , so that it is good to powre vpon the

The making and refining

change of the nexte yearth, and so you maye procede, gathering a good quantitie of suche water, taking hēde neuerthelesse, that it be full of the substance of Saltpeter: the whiche if it seeme vnto you, not of the same perfection, as you woulde haue it, you maye polye it againe vpon the verie same yearth, or vpon other new, till suche time as it satisfie you, and that you knowe, that it be full of the substance of Saltpeter. Besides this, there muste be made a furnes with one or .ij. cauldrons of brasse walled thereon, whiche muste be as greate as those that the Diers vse, and these cauldrons muste then be filled, with the foresaide Saltpeter water: the whiche (as alredie I haue tolde) oughte to be as full of substance as maye be, so that it haue aboute the .ij. third partes, and make it faire and sofflie to boile so much till it come to one thirde part, or there aboutes: and after take it of, and put it to settell in a greate vessel, couered, whiche muste be well bounde aboute, with hopes of yron, and sure and close in the ioyning thereof, to the intente it spill not: and thus when the same water is settled and well clarefied, and from the yearthe and grosse matter, whiche in it remained, diligently purged, it muste be taken oute and boyled againe of newe in the same cauldron, or in some other: and for as muche as euerye time that it boileth, if it be not taken hēde of, it turneth into skum, and sometimes swelleth so muche, that often times running ouer it spilleth, and carrieth awaye therewith muche of the good: the whiche minding to remedie, you muste take thre partes of Wke ashes, and one of lime, and moze ouer, in euerye hundreth pounce waighte of water, there muste be dissolued fower pounce of roche Alum: and when the cauldron boileth, take of the sayde water with a pot, and polye into it ones or twise, and specially when you see the Saltpeter water rise in skum, whiche in a little while you shall see it alate, bothe clere
and

and faire, and of an azur colour: and it muste bee boyled so long, till all the thinne watrinesse bee vapoized away and the substance of the Saltpeter thickened: so that it being taken out, and put in chestes or tubbes and cooled, maye congeale: the whiche is best done, when the water is brought to least quantitie, taking it out and putting it into a lesse caudron, wherein it will sooner congeale: the whiche water being tasted, and scene to bee brought to suche passe, to bee reade to congeale, you maye take it out, and put it in vesselles of wood, or of earth that are rough within, with certayne stikes of wood, to congeale, and so you shall let it coole, and rest. iij. or iiij. daies, so as it maye drop, and be strayned through some litle hole, in the bottom of the vessell: and all the water that is not then congealed, you must take out and saue for to seeth againe: and the Saltpeter that is in anye quantitie congealed, you shall finde to bee, according to the vertue that was in the water, or in the earth: but the clerenesse and fairnesse thereof, will come of the maister vertue of the water, that is put into it in the boyling, which hath strength to purge it, and make it come, as it were refined in the first seething: nowe this being taken from the sides of the vessell, where it congealed, and in the water therof washed, you must laye it vpon a table to drie throughe: and the same seeming vnto you to haue neede, or neuerthelesse minding to haue it aboue the common vse, for some purpose, more purified, & without earthy grosnesse, & altogether without fatnesse and saltnesse, whiche for to make exceeding fine powder, or aqua fortis, is most requisit so to be: to be short, for what so euer cause it oughte to be refined, I counsell you, to do it after one of these y. wayes, whiche here following, I shall teach you: The first, which I like best, is with water: and the seconde is with fire, with water it is refined in this maner, taking of the foresaid mixture made of lime, ashes, and allome dissolved: and

The making and refining

then for euerie barrell of water that you haue put in the cauldron, for to disolue the Saltepeter, you muste put into it fire pottfulls of the foresayd strong water: and in the same quantitie of water so prepared, put so muche Saltpeter as you thinke maye well be dissolved: and with boyling make it to resolue verie well, and seeing it in boyling to haue caste by scum, you shall then take it oute of the cauldron, and put it into a tubbe, in the bottome where of, you muste firste haue put fower fingers thicke of fine sande cleane washed, and that muste be couered with a linnen clothe: and by a littell hole made in the bottome of the tubbe, you shall suffer it to droppe by littell and littell into some other vessell set vnder to receiue it: & so this water thus strained, you must after put in the verie same or in an other cauldron to boile agayne, and to make the greater parte of the same water, that you put into it see the awayne: finally make it boile so muche, vntill you see it readie to thicken, powering nowe and than, in making it, a littell of the foresayde strong water, and speciallye when it swelleth and casteth by scum: and this thing (being so handled) you muste take it oute of the cauldron, and put it in chestes or other vessells of wood, to congeale: whiche, being a greate quantitie, in three or fower dayes, you shall finde all that congealed, which will congeale: which, being taken oute, you muste order as you vled afore the other: and the same water that is not congealed, muste be boyled agayne: and so you shall doe from time to time as it gathereth together and congealeth: and after this sorte you shall make the Saltepeter moste white and faire, and much better then at the firste seeing.

Also saltepeter is refined in an other manner, whiche is with fire, but in a littell quantitie mending to doe it well: and although it be a readie waye, yet fewe vse it: albeit it serueth to get oute the fatnes of saltepeter,

ter, for that it sendethe into the bottome verie muche
 yearthynges, notwithstanding I like better the foresaide
 waye in purging it with water, then this with fire:
 But to do this, take a salet, or some other yron or
 brassen vessell, and fill it with Saltpeter, and couer it
 with a couer of yron, brasse or yearth, so that it be made
 bigge inoughe, meete to be taken of and put on when
 you liste, that the vessell maye be well couered: and
 then it muste be set in the midst of a good fire of
 coles, and so the Saltpeter will melte, whiche is some
 perceyued of the experie artificer: but when you thinke
 that it is molte, looke vpon it: and if it be not well mol-
 ten, couer it agayne and let it melte well: then it being
 well molten, take brimstone mooste finelye beaten in
 powdier, and strawe some thereon: and if of it selfe it
 take not fire, do you kindell it: and being kindeled
 let it burne till suche time as the brimstone be all con-
 sumed, so that nothing els be burnt, but the vpper
 parte, and certayne grosse vnctiousnes of the Saltepe-
 ter, the whiche when it is burned, will leaue the reste
 faire and cleare: and then it muste be taken from
 the fire letting it coole, where in the vessell you shall
 find it (when it shalbe coulde) all in one peece white
 like vnto a peece of marbell: and all the yearthynesse
 thereof remayning in the bottome: whiche shalbe good
 saltpeter to make powdier withall, but not verie com-
 mendable to anie other vse: and aboute saltpeter the
 witte of men haue so muche imaged, that meanes
 are founde to cause it to growe in the grounde, and in
 places: that neuer had anie before, by dissoluing Salte-
 peter in water: for with the same water wetting the
 grounde, and letting it stande so a certayne space of
 time, saltpeter wil be ingendred, so that the same that
 was put there, will multiplie wonderfullly: and it is
 a mooste certayne thing, that in making Saltpeter,
 the yearthe that hath bene occupied, heaped vp in a

place that is couered, so that the rayne do not walthe it, within the space of fīue or sīxe yerres, maye agayne bee laboured, and Salt peter shalbe founde to be ingendred, and yelde much more, then it dyd the first time : & this that I haue declared in this chapter, is as much as I can saye of Salt peter.

¶ The maner howe to make all sortes of Gun-
pouder. Chapter xxiii.



Vn powder, is made of three
simples onely: that is, saltpe-
ter, Brimstone and Coales:
and some propoztioneth it
after one fashion, and some
after an other, and also accor-
ding to the Gunnes, and pur-
poses, toherewith they will
occupye it For that one sorte
is occupied for great ordi-
nauce, and an other sorte for lesse peeces: and this is
knowne to euery Bombardier: In Warkebuses, and
hande gunnes, is not occupied common powder, but a
boutte certayne fire workes: and therefore to euery
of the sayde purposes, the pouders is propoztioned ac-
cordingly For that if Serpentine powder, should be oc-
cupied in hande gunnes, or Warkebuses, it woulde scāt
be able to driue their pelletes a quaites casse fro their
mouthes: and if hande gunne powder should be used
in peeces of ordinaunce, without great discretion, it
woulde quickly breake or marre them: and to minde
to haue all sorte of pouders good, thre thinges is requisit
to be obserued, in making therof. The first is to see,
that the substaunce, wherewith it is made, haue no
earthie grossenesse. The seconde, that it be finely bea-
ten: the thirde, that it be verpe well dried, from all
humid

humiditie or moistnesse, and this done, you shall haue strong and excellent good powder. And it is to be vnderstanded, that y^e chiefe thing that is in powder, is Saltpeter: for that of it (by the same that is seene) dependeth all the force. And therefore prouision is to be made, to haue a good quantitie thereof, and that it be cleane and nete: the which by burning, maie well be knownen, for that in all sortes of powder, it is needefull, that the Saltpeter be good.

Now, for to make common powder, for greate peeces of artillerie there must be taken thre partes, of refined Saltpeter, two of Willowe coles, & one of Brimstone, and grinding euery thing: all muste be well mingled together, & all the moistnesse thereof dried vp, as I haue saide. To make powder for small peeces of artillerie, there muste be taken fve partes, of refined Saltpeter, and one and a halfe of Coles, and one of Brimstone, & grinding it moste finelie, and mingling it well together, it muste be cornd, and then dried. The maner of corning all sortes of powder, is with a Sæue made, with a thicke skirine of Parchemēt, full of little round holes, into the whiche Sæue the powder muste be put, while it is dancke, and also a little bowle, that when you lifte, it maie roule vp and doune, vpon the clottes of powder, to breake them, that it maie cozne, and runne throughe the holes of the Sæue.

To make Harkebuse and hande Gunne powder, there muste be taken fenne partes of refined saltpeter, and one of young hasell cooles of a yeare olde made cleane, and one parte of Brimstone, and beating all in a moztar, or grinding it exceedingly well that it maye be mingled together and so fine as is possible, the it muste be cornd and thoroughlie dried. And note that if it be not marueylously well beaten, it wil neuer be good. But because making of powder, whiche are of thinges that will easylie kindell, cannot be withoute
peril

perrill of him that maketh it, excepte it be remedied with wetting: therefore it behoueth to take hâde that it be not beaten drie, as well to auoyde suche perrill, as also for that it will be beaten better: for whiche causes it muste be wet with comun water to a certaine degree of moistenes, so that taken vp in ones hande it maye cling together.

Some moisten it with vineger: and some, for to make it more stronger, with câphozed, aqua vitæ. When I haue caused gunpouder to be made, I haue vsed comun water, & therefore I am able to saye whiche of those thinges is beste: and to tell my opinion, I doubt whether vineger or aqua vitæ, causeth the gunpouder to be any better then the comun water: for as much they vapozyng awaye, as they do, & as of necessitie they must, I beleue that littell of their substance remayneth.

There be some whiche in making coale (besides willow) make the of hasell: & some of vyne sticke: & some of baye sticke: some of reedes: some of kexles: & to be shorte, all the coales that are made of softe wood, are of wood which haue much pith: but it is requisit that they be smalle, yong, and tender, and withoute hardenes of knottes: otherwys they be not good.

Albeit they be made in diuers maners: but in making of any great quantitie of pouder, the ordinarie coale is to be taken: and making a littell, they vse to take yong hasell of a yeaere olde, cut in shorte peeces, and they putting them into a greate pearthen potte, or other vessell of yron, or brasse, they shutte it and cener it close, and lute it, or daube it very well aboute, so that it cannot breathe: and then they make fire rounde aboute it and vpon it, till suche time as it maye be thoughte that the heate is well entred in throught all, and that the wood that is within is very well fired: and without fire, vbandes, or flame, burned onely throughte suche heate: and then they take the fire from the potte and let it coole,

Howe too
make coole
vwhere vwith
gunpouder
is made.

cole, and so they finde the same wood become cole. I hapning once to haue neede of coles (to thintent to make some quicklie,) toke as manie drie hasel stiches that had their rindes scraped of, as I thought sufficiente to serue my purpose: and breaking them in peeces and laying them close together on a heape, I set them on fire and burned them all well, and then sprinckeled water vpon them with a bosome, and with the same wet bosome quenched the fire: and so scattered abode y coles here & there, alwayes sprinckling water vpon the till I quenched them: and thus I haue serued my purpose withoute so muche difficultie.

Moreover, it is a verie profitable thing, yea and a necessarie, that I declare the maner and facilitie of beating it, for to be able safelie to make a greate quantetie thereof. In olde time they were wonte to grinde gunpowder with certayne handemilles, as they vse to grinde corne, but (besides the paine) it is a waye verie perrillous: for that suche a composition gronde together with stones, will catche heate in suche wyse, that it will sone ingender fire, inespacially euery thing being a matter disposed to fire: as also by rubbing together with violence a couple of baye stiches, you shall fraighte waye kendel fire. Some grinde powder in suche milles as they vse to grinde crabbes or apples to make bargis or sider: and some hath it stamped in morters with a water mille or a horsemill, whiche waye is the beste of all other, and mosse surest and also it is beaten finelier, and with lesse labour and payne: Some (that hath not the comodetie of water) make a greate wheele, deuised after such sorte, that with the cogges thereof it may raise vp many heauy pestels, which falling, beate in diuers morters of wodde made in a beame of oke, of the whiche there be some haue the bottoms of braise.

Some stampe with their armes, with a greate pestel

The making

tied to the ende of a pole with a corde, righte ouer, a mortar of wood oz brasse, and so they beate the easelie: other some beate it in a stone mortar, with the mouthe somewhat large, with a wooden pestell, with the handell thereof made like vnto a hammer oz a mall. And these, and other, that maye be made, is as much as aboute the deuise of beating and making gunpowder is needefull.

They haue vsed heretofore to waighe euery matter by it selfe, and then they haue gone mingling and beating all together: There haue bene after, some that haue deuised to beate euery thing seuerallye by it selfe, and then mingelled altogetheer and made it. But finally the beste and moste readiest waye, is to take a quantetie of Saltpeter, wherewith you will make youre poulder, and put it into a cauldron with so much water (as being set vpon the fire) maye be thought sufficiente to dissoule it: whiche so sone as it is resolued, muste be taken of and set on the grounde in a colde place: and the quantetie of beaten coles that is sufficiente, muste be put into it, and so stirring it aboute, muste be mingled well with the Saltpeter dissolued: and then taking youre bzimstone finely beaten in powder, and with a staffe stirring aboute the coles and the Saltpeter, you muste strawe it finely vpon the same, as well as you can, with continuall stirring and mingling them together, whiche composition thus made, you muste then drie somewhat in the sunne: and then to haue it excellently well made, there needeth no other to be done, but to beate it all together, to the intent that it maye incorporate moste finely, whiche done, you muste drie it with moste greate diligence: and then sift it very well through a sieue, and moistning it againe with water oz vineger, stirring it somewhat together in a sieue, you maye cozne it as already hath bene declared: and then againe for to occupye it aboute
your

your businesse your muste drye it well : and so being dried, put it into drye vessels of wood to keepe : and set it in the highest places of your house, where few commeth for diuers respects: and though it were for no other, at least to keepe it drie. They that are expert, knowe good powder in this maner, by the colour: for that if it be very blacke, it is a signe y^e it is made with very muche coles: or that it is moyste : and when you rubbe it vppon a peece of paper it will blacke it moze then it ought to doe : and drawing it with your finger , you maye see whether it bee finely beaten or no : for it muste bee so much beaten that nothing , neither of Saltpeter nor of Brimstone bee discerned in anye wise : for with reason they oughte not to bee seene : they take also for a triall, thre or foure cornes of powder , and laye them vpon a white Paper , distaunte thre fingers , the one from the other , and fire one of them : and if the powder bee good, you shall see them all to fire at ones : so that there shall bee no residue remayning , neither grossenesse of Brimstone, nor of Saltpeter , nor of any other thing, and the paper not burnt.

And if it be not so founde , they knowe that it is euill made , or not good , but full of earthenesse of Saltpeter : or that it is moyst, so that it is naught for shooting of ordinance , besides the perill that it putteth them in. And vndoubtedlye naughtye powder , is a cost halfe caste awaye : and it is a great faulte in him that maketh it , or that causeth it to bee made : for that in time of neede , it is of no effecte , and causeth muche shame to the Gunners , which occupie it: and therefore diligence oughte to bee vsed, and good heede taken that it be made according as I haue taughte. There are manye whiche bring vp lies , saying : that they can tell howe to make powder that shooting it in gunnes shall make no noise , the whiche is impossible, the fire and the aire violentlye encountering together , where besides that

The making

they are not able to do the same they saye, with a peece of ordnance, they are lesse able to do it with one of those postgunnes of elder, that boyes vse to shut paper and floures in, by the noise of which, maye well be perceiued, that all procede of breaking of y^e ayre. Also there be manye that saye, that they can make white powder, that shall not blacke ones handes, by putting in a certaine thing in the steele of coles: some other, redde, with dyed red floures: and other blew, with blew flowers: some other saye that to make the powder of more force and strength, that it is very good to put to euery pounce of bymstone an ounce of mercurie, y^e bymstone being first put in by a litle, and a litle. Moreouer there are some other that saye, that for to make the like, there ought to be put to euery pound of Saltpeter, a quarter of an ounce of Salt armoniack: some other there be also, whiche saye that in the steele of coales, it is better to take linen cloth and to burne it to tinder, and therewith to make powder, whiche is more excellenter then anye other coale that is possible to be vsed, about suche a purpose. And although that in my iudgement I haue declared already the best receites, that is for the making of all sortes of gunpowder, yet to the intent that it may be vnderstande howe much men haue trauayled and imagined to bring the same to all perfectio, I haue thought good to shewe here following diuers moe receiptes both good and bad, which for the making of powder hath bene experienced of sundrie men.



*The first inuention and oldest maner
in making of sarpentine powder, or powder
for ordinaunce.*

1 Saltpeter	i. parte.
Wrimstone	i. parte.
Coles	i. parte.

*The nexte practis of making powder
for ordinaunce.*

2. Saltpeter	iiij. partes.
Wrimstone	ii. partes.
Coles	ii. partes.

¶ Powder for ordinaunce of a newer making.

3. Saltpeter	x. partes.
Wrimstone	iiij. partes.
Coles	iiij. partes.

¶ Powder for ordinaunce not so olde.

4. Saltpeter	xij. partes.
Wrimstone	iiij. partes.
Coles.	ii. partes.

Powder for ordinaunce not verie olde.

5. Saltpeter	ix. partes.
Wrimstone	iiij. partes.
Coles	iiij. partes.

Powder vsed of late daies for handgunnes.

6. Saltpeter

The making

6. Saltpeter
Wimstone,
Coles

iiii. partes.
i. parte
i. parte.

Pouder for ordinaunce bled not
so long agon.

7. Saltpeter
Wimstone
Coles

rr. partes.
iii. partes.
r. partes.

¶ Powder for ordinaunce vsed of latter daies.

8. Saltpeter
Wimstone
Coles

c. partes.
r. partes.
xxvj. partes.

¶ Grosse powder of a newer sorte.

9. Saltpeter
Wimstone
Coles.

c. partes
rr. partes.
xxvii. partes.

¶ Fine powder of a making not very olde.

10. Saltpeter
Wimstone
Coles

ir. partes.
iiij. partes.
vj. partes.

¶ Grosse powder of a newer making.

11. Saltpeter
Wimstone
Coles.

ij. partes.
i. parte.
i. parte.
Varka

Harkabus powder of a newer making.

12. Saltpeter	iiij. partes.
Wimstone.	i. parte.
Coles of willowe stickes	i. parte.

¶ Fine powder of a nevver making.

13. Saltpeter often refined	v. partes
Wimstone	i. parte.
Coles of young hasell stickes	i. parte.

¶ Grosse powder of a nevver making.

14. Saltpeter refined	iiij. partes.
Wimstone	i. parte.
Willowe coles	ii. partes

Powder of a nevver making.

15. Saltpeter	x. partes.
Wimstone	ii. partes.
Willow coles	iii. partes.

¶ Harkabus powder vsed novve adayes.

16. Saltpeter very often refined	x. partes.
Wimstone	i. parte.
Coles made of Hasell twigges with the barke pilled	i. parte.

Handegun powder of a nevver making

17. Saltpeter refined	xxvij. partes.
Wimstone	iii. partes
Coles	

The making

Coles of hasell hauing their rindes pilled of. iij. partes.

¶ Handgun powder of a stronger and of
a newer making.

18.	Saltpeter refined	vij. partes.
	Wimstone.	i. parte.
	Coles of young hasell	i. parte.

¶ Finer and stronger handegun powder.

19.	Saltpeter diuers times refined	vij. partes.
	Wimstone	i. parte.
	Coles of young hasell twigges hauing their rindes pil- led of	i. part.

¶ Grosse powder vsed novve a daies.

20.	Saltpeter	iiij. partes.
	Wimstone	i. parte.
	Willowe coles	i. parte.

¶ Grosse powder vsed novve adayes.

21.	Saltpeter	xx. partes.
	Wimstone	iiii. partes.
	Willow coles	v. partes.

¶ Handegun powder vsed novve a daies.

22.	Saltpeter refined drie	xviii. partes.
	Wimstone cetrine	vii. partes
	Hasell coles	ii. partes.

Handegun powder vsed novve adaies.

23.	Saltpeter refined	xviii. partes.
	Wimstone	ii. partes.
	Hasel coles	iii. partes.

The

¶ The māner that is vsed of charging and shooting
of ordinaunce. Cap.xxv.



Or asmuche as if Gunners
Should chaunce to bee slaine
oz otherwise lacking, to the
intent that euery souldiour
in time time of nēde maye
knowe how to serue in one
of their stēdes, I haue
thought god and necessarye
to shew and declare the ma-
ner of charging & shooting

of pēces of ordinaunce. Wherfore it ought to bee vn-
derstande, howe muche powder is occupied at once in
charching of euery pēse, whiche moste commonly, is
is two thirde partes, of that which the shotte oz bullet
thereof wayeth: as for example if the bolet of a pēse
of ordinaunce waighe. xxi. pounce, then there must bee
taken. xiiii. pounce of powder for the iuste charge of the
same pēse. And then with a long staffe that hath at
the one ende a bob as big as the bolet of the pēse, and
at the other ende a lable made for the same purpose
that will take so muche powder bp at twise oz thrise, as
is aforesayd, the pēse must be charged, after this sort.
Take the ladle full of powder., and thrust it into the
Gunne so farre as it will go, & then turne your hande
with the ladle. that the powder maye fall out & remaine
there behinde when you pull out your ladle: whiche
done, you muste with the bob ende thereof, thrust the
powder home faire and softely: and so with the ladle
taking bp the rest of the powder you must do likewise,
and thrust after at the last a wispe of hey oz of some
thing els, to swepe all the powder together, and then
the bullet whiche muste bee of a fit biggnesse for the
pēse: And also an other wispe to stape the bollet for
roling oute: and putting some powder in the touchhole
and aboute the touch: hole, the Gunne is then charged.

A discourse

So we to tell it, a man must stande directly behinde it, and with a leuer, tourne it this waye, or that waye till suche time as it be broughte to lie iuste, as a man will haue it, so that looking straighte from the breach or hinder parte of the peece as lowe as maye bee vpon the vpper parte thereof, he maye see the mouth of the peece to lye euen with the marke and as it were to couer it: whiche done, if the grounde wheron it standeth, bee euen, as it is requisite to bee, and that the one whele stande not higher then the other, giuing fire to it with a linte stocke whiche is a matche fastened to the end of a staffe of a yarde or two yardes long, you shall see the shot to strike the same thing that you shot at, if it bee within anye reasonable distance. And for more speedie shooting of ordinaunce, the iuste charge in powder of euery peece may also haue be prepared in a readinesse, and put in bagges of linnen or in great papers made for the same purpose, which in a sodaine may be chopt into the mouth of a peece with the bollet or shot thereof thrust after, as farre as they will go, and then thrusting a long wyer into the touchehole that maye perse through the bagge or paper wherin the charge of powder lieth within the peece, filling the same touchehole with cozne powder so soone as it is leueled, it maye instantly be shot of: whiche maner of charging is done most quickly and a great deale sooner then any other waye, and when laste requires, very needefull.



¶ How to get out quickly the nailes that should hap-
pen by treason, or otherwise to be driuen into the
toucheholes of ordinaunce.

Cap. xxvi.



If it shoulde fortune at some
sodaine assault, the touche-
holes of the artillerie to be
napled vp, after suche sorte
as they cannot be dischar-
ged, or shot of, the speediest
waye to vnnaille them, is
firste to charge againe all
suche peeces of artillerie,
with smaller bulletes the

their ordinarie: and when they are so charged, to leuel
them towarde those places where neede requires, eue
as they shoulde haue bene, if they had not bene nai-
led: and then there must be made a traine of powder,
along the bottome of the canes, from the mouthes to
the bollettes of euery pece of ordinaunce: and to the
intente not to shote them in vaine, you maye farrye
for occasion, and occasion seruing to shote them, you
maye giue fire at their mouthes, where besides that
they shall do their ordinarie effectes, they shall all in
the discharging, be vnayled, blowing oute the same
nailes or pinnes of yron, wherewith their toucheholes
were stopped: and so doing, of suche nailing there shall
happen no great harme. But if some of them for be-
ing beating in harder then other, shoulde chaunce at
the first not to be driuen out, then the remedye is, to
charge them againe, & to shote them of, after the saide
manner, putting on the toucheholes a litle oyle made
very hot, heating also first the place that is nailed, with
a burning coale, making mozeouer with claye, vpon
the pece, a litle cuppe aboute the hole, that maye
holde the hot oile that is poured vpon it, after suche

A.ij.

sorte,

A discourse

sozte, that thzough the heate thereof, it maye soke into the hole with the yzon in it, whereby the same yzon shall then be made so slipperly, that at the next discharging of the peece, the fury of the fire most easly shall blow it oute.

¶ Howmuch the artillerie ought to be esteemed of the armies novv a daies, and whether the same opinion of them whiche is had vniuersally, be trevve,

Cap. xxvij.



Onsidering howe many battailes and deedes of armes, were made of y Romanes at sundrie times, there is come vnto mee in consideration, the vniuersall opinion of manye men, which is, y if in those times there had bene ordinaunce, the Romaines should not haue bene able to haue conquered, noz so easly haue won the ceutries, and made the people their tributaries, as they dyd, noz they should not haue in any maner made so mightie conquestes. They saye also, that by meane of this instrument of fire, men cannot vse, noz the we their strength and vertue, as they might in olde time. And they adde a third thing, that they come with moze difficultie to fight a field then they came in those daies, noz their cannot be kepte in them the orders of those times, so that at length the warre shalbe bzoughte to consist altogether in artillerie. And minding to wryte, whether such opinion be true, and howe much the artillerie hath increased, oz deminished the strength of armies, and whether it taketh awaye, oz giueth occasion to good Capitaynes to do valiauntlye, I will begin

beginne to speake concerning their firste opinion, that the auncient Romaine armies shoulde not haue made the conquestes whiche they did, if the ordinaunce had bene in those dayes. To which answering I say, how that warre is made eyther to defende, or to offende.

Where first it is to be examened, to whom these two maner of warres causeth moste profite, or most hurte. And albeit there is what to say of either part, notwithstanding I beleue, that withoute comparison, they doe moze harme to him that defendeth, then to him that inuadeth. The reason is, that he y defendeth, is either in a towne, or in a campe within a trenche. If he be within a towne, this towne is eyther littell, as the moste parte of fortresses are, or it is greate. In the first case, he that defendeth, is altogether losse: for that the violence of the artillerie is suche, that there is no wall, how greate so euer it be, which in few dayes it battereth not down. And if he that is within, haue not space inoughe to retire, bothe with ditches, and with rampiers, he is ouercome, because he is not abel to withstand the violence of the enemye, whom throughe the breach of the wall, will after enter: nor in this case, the artillerie whiche he shoulde haue, shall not helpe him: for that this is a generall rule, that where men in a throng, & with violence may go, y artillerie cannot withhold them. Therefore in the defence of a towne, the furie of the enemies cannot be withstand. Though the assaultes the which are not thronged, but scattered, which be called skirmishes be easelye withstode. And they whiche goe with this disorder, and coldenesse to a breach of a walle, where artillerie is, doe goe to a manifeste deathe, and agaynste them the artillerie preuaileth: but those, which assaulte a breach in a throng harde together, so that the one thrusteth forward the other if they be not holden oute of ditches, or of rampiers, they enter in euerye place, and the artillerie keepeth them

A discourse

them not backe, and though some be slaine, they cannot be so many, that they shall not let the victorie. This is knowen to be true, by many expugnacions of townes made in Italy, and in especiallie in the same of Brescia: for as much as the same Towne being rebelled from the frenchemen, and yet the fortresse being kept for the king of Fraunce, the Venetians for to withstande the violence, which from the same might come into the town, had laid all the streete full of Artillerie, which descended from the fortresse to the Citie, & they planted them on the fronte, and in the flankes, and in euery other fit place. Of the which Mounsier de Foix made no other coupte, but with his squadrons, coming downe on foote passing through the middest of them, gotte the citie: nor it was not knowen that he receiued by those any notable hurte. So that he that defendeth him selfe within a littell Towne (as hath bene sayde) and findeth the walle on the grounde, and hath not space to retire with rampiers, and with ditches, and is constrained to truste vpon the artillerye, is overcome straight way. If thou defendest a great town, & where thou hast commoditie to retire, yet notwithstanding withoute comparison, the artillerie is more profitable to him which is withoute, then to him that is within. Firste, to minde to haue a peece of Artillerie hurte those without, thou art constrained to gette the vp with it from the playne grounde of the Towne, because standing vpon the plaine grounde, euery littell bancke and rampier that the enemy maie make, shall cause him to remaine safe, and thou canst not hurte him, so that being driuen to stande a losse on the toppe of the walle, or in what so euer other maner on highe, thou drawest after thee two difficulties. The firste is, that thou canst not bring vp so greate and mightye peeces of artillerie, as he withoute may shote, being not able in littell spaces to handell great thinges. The
other

other is, that although thou couldest bring them, thou canst not make such strong & sure defence for to save & said artillerie from dismounting, as they without may doe, being on the ground, and hauing that commoditie & that roome, that they them selues like. So that it is impossible for him that defendeth a towne, to keepe the artillerie on high places, when they which are withoute haue greate ordinaunce inough. And if they be driuen to come with the on lowe places, they become for the moste parte vnprofitable, as hath bene sayde. So that the defence of the citie, is brought to be defended with armes, as in olde time they did, and with small artillerie. Of which if there be gotten a littell profite (hauing respecte to the same small artillerie) there is gotten so much incommoditie, as counterpeaseth the commoditie of the artillerie: for as much as hauing respecte to the same, they make the walles of townes low, and as if were vnder ground in ditches, so that so soone as they come to the battaile at hande, eyther because the walles are battered, or because the ditches are filled vp, he y is within, hath much moze disaduantage, then he shoulde haue had in times past. And therefore (as afoze is sayde) these instrumentes helpeth much moze him that besiegeth a towne, then he that is besieged. Concerning the thirde thing, to lye in Campe within a trenche, to the intente not to fighte the fiede but at thy commoditie, or aduantage, I saye, that in this parte thou hast no moze remedy ordinarie to defende thee from fighting, then they had in olde time. And sometimes, considering the artillerie, thou hast greater disaduantage: for that if the enemye meete with thee, and haue a littell aduantage of the countrey, as may easely chaunce, and finde him selfe higher then thou, or that in his coming thou hast not yet made thy banckes or rampiers, and couered thee well with those, straight waye, and befoze thou haste anie reme-

A discourse

die, he vnlodgeth thee, and thou arte constrained to issue oute of thy fortresse, & come to fight: the whiche happened to the Spaniards in the battaile of Nauenna, who being fortressed betwen the riuer of Monaco, and a bancke, because they lay, not so highe as sufficed, and for that the Frenchemen had a littell the aduantage of the grounde, they were constrained of the artillerye to issue oute of their fortresse, and come to fight. But admit that the place, which thou haste taken with the campe, were muche higher, then the other againste it (as for the most part it ought to be) and that the bankes or rampiers were good and sure, so that by meanes of the situacion, and thy other preparacions the enemye durst not assaulte thee, it shall come in this case to those maners, which in olde time it came, when one was with his army in place not possible to be hurt: the which are to ouer run the countrie, to take, or besiege the townes that are thy friendes, to stoppe thee thy victuals, so that thou shalte be constrained of some necessitie to vn lodge, and come to fight the field, where the artillerie (as hereafter shalbe sayde) doth not muche hurte. Considering then what kinde of warres y Romaines made, and seing how they made almoste all theyr warre to inuade other men, and not for to defende them selues, it shalbe seene (when the thinges sayde afoze be trew) how they should haue had moze aduantage, and muche sooner should haue made their conquestes, if ordinaunce had been in those daies. Concerning the seconde thing, that men cannot shew their strength, as they mighte in olde time, because of the artillerye, I saye, that it is trewe, that where men scattered do shewe it, they stande in moze perrill, then in those dayes, when they had to skale a Towne, or to make like assaultes, where men not thonged together, but senerally the one fro the other did apeare. It is also trewe that the Capitaines, and headdes of armies

armies, stande more subiecte to the perrill of death: then in those times, because they may be reached with artillerie in all places, no: it helpeth not them to bee in the rerewardes, garded with mosse strong men. Notwithstanding it is seene, that the one and the other of these two perrills, doe seldome times extraoꝝdinarie hurtes, for that the Tounes well appointed and furnished with munition are not scaled, no: they goe not with weake assaultes to assaulte them: but minding to winne them, the matter is brought to a siege, as in olde time they did. And in those, which neuertheless are won by assaulte, the perrills are not much greater then they were in those daies: for that also in those times, they which defended a toun, lacked not thinges to thꝛowe and shote, the which (though they were not so furious) they did concerning the kylling of men the like effecte. Concerning the death of Capitaynes and conducters, there hath been in .xxiiij. yeares that the warre was of late dayes in Italy, lesse examples, then there was in .x. yeares with the antiquetie: for that excepte Counte Lodouike of Mirandola, who died at Ferare, whē the Venecians, a few yeares ago, assalted the same state, and the Duke of Nemours, which died at Cirignuola, there hath not hapned of the artillery any to be slaine: for as much as Monsieur de Foix at Rauenna, died of yꝛon, and not of fire. So that if men shew not peticularly their strengthes, it groweth not of the artillerie, but of the naughtie orders, & of the weakenes of the armies, the which altogether lacking strength, cannot shew it in parte. Concerning the third thing sayde of them, that men cannot come to hande strokes, and that the warre shalbe brought to stand altogether vpon artillerie, I saye, that this opinion is altogether false: and so alwaies shalbe taken of those, who according to the anncient vertue will occupie their armies: for that he that will make a good armie, it behoꝛueth him with exercises, eyther sained, oꝝ frew, so accus-

of Muynes.

to come his men to geue the charge on the enemy, and to come to the swoydes pointe with him, and to the graspyne by the boosome: and he ought to grounde him selfe moze vpon the footemen, then vpon the hoysmen. And when he shall ground him selfe vpon the footemen, and vpon the sozelayde maners, the artillerie becommeth altoget,er vnprofitable. For that with moze facelity, the footemen in aprouching nare the enemy, may auoide the shot of the artillery, then they were able in olde time to auoide the violence of Elisants, of cartes full of hookes & of other draunge incoüters, which þ Romaine footemen incountered withall, against which, alwayes they founde the remedie, and so muche moze easelie they should haue found against this, the shozter that the time is, in the which the artillery may hurte thee, then the same was, in the which the Elisantes & the cartes were able to hurte: for as much as they in the middell of the fighte, disozdered men, these onelye befoze the fighte trouble men: the which impediment the footemen easelie auoide, either with golwing couered by the nature of the situacion, or with falling downe vpon the grounde, whē they shoote: the which also by experience hath bene scene not to be needefull, in especially to be defended frō greate ordinaunce, the which cannot in such wyse be leuelled, because if they go we highe, they touche thee not, & if they go w lowe, they will not come nare thee. Then the armies being come to handestrokes, this is moze cleare, then the lighte, that neyther the greate, nor the littell can after hurt thee: for that if the same, which hath the artillery, be befoze, it becommeth thy prisoner, if it behind, it hurteth the friende befoze thee. Againē on the backe it cannot hurte thee after such sozte, that thou art not able to go w to winne it, and it commeth to follow the sayd effect. For this neede not much disputacion: for that there hath bene scene the example of the Suizers, whow at Pauara in the yere of our Lorde, 1513. without artillerie,

artillerie, and withoute horse, wente to incounter the
 Frenche army furnished with artillery within their se:
 tresse, and they ouerthrew the withoute hauing any im:
 pediment thereby: and the reason is (besides the thinges
 told afoze) that the artillerie in ynding to haue it worke,
 hath neede to be garded eyther of a wall, or of ditches,
 or of bankes. And when it lacketh one of these gardes,
 it is taken, or becommeth vnprofitable, as it happeneth
 when it is defended with men, for when they chaunce
 to be in a battaile, and in the fight on the lande, they can
 not be occupied by flanke, but in the same maner, that
 the antiquitie occupied the instrumentes to shote, which
 they placed out of the Squadrons, for that they shoulde
 fight out of the orders, and alwayes whē eyther of horse,
 men, or of other they were charged vpon, their refuge
 was behinde the legions: he that otherwise maketh ac:
 compte of them, hath no skill, and trusteth vpon a thing,
 which easely may deceyue him. And though the Turke
 by meanes of artillerie, against the Sophi and the Sol:
 dan, hath had victoꝝy, it hath not happened through other
 meanes, then through the feare that the horsemen were
 put in by the straunge rumoꝝ thereof. Therefore to
 make an ende of this discourse, I conclude, that the arti:
 llerie is profitable in an army, when the auncient
 vertue is mingled therewith, but withoute
 the same, against a puissant army,
 it is mosse vnprofitable.



of Muynes.

¶ Of Muynes and placing of poulder vnder grounde,
wherewith inuincible fortresses, by fire maye be
ruinated, when ordinaunce cannot
bee brought vnto them.

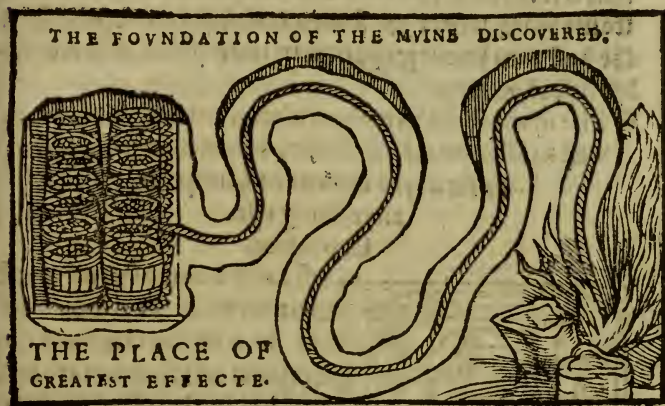
Capi. xxviii.



He better and greater quan-
tietie of poulder which is put
in a Caue that is made to o-
uerthrowe a fozte or Castell,
the greater vndoutedlie shal-
be the effecte thereof: which
caue is best to be made a good
waye within the ground, and
in a harde place, to the intent
that when the same is shutte

& well walled by, the fire be not able easely to haue any
other waye oute, then in ouerthrowing the thing y is to
be ruyned. soz as much as if the aire, & the fire in y rōme
of that inclosed place, may haue meanes to bzeathe out,
the fozce therof wilbe of no effecte. Also it wold be take
hēde of, that the caue be not by no other meanes made,
so that the fire maye bzeake oute: : soz which cause, it
ought to be made, with the beginning thereof somewhat
distant frō the place, that you minde to ouerthrow: to the
intent that in making thereof, the men of the same place
do not issue oute to let you, noz perceiue the certaine
place of the hurt, to be able to prouide soz it, and to make
countermuynes to let the fire bzeathe oute and pas with-
oute anie effecte, whereby all youre coste and laboure
may become vaine. Fozeouer they make these muines
the moste naroweste and moste crookedest that maye
be, and in especially nēre the very place that is ap-
pointed to be ouerthrowen, and therefore vnder such a
place there muste be digged a hole that maye be at
leaste

least thye yardes high or more, and two yardes broad
and that the entrie vnto it bee vndergrounde in the
maner, as by this presente figure you maye see descri
bed.



And in this to put barrells with their heades knoc
ked oute full of good strong powder, betwæne which you
must also strawe powder ynough vpon the bozdes wher
on they stande, laying to it a good great matche made of
cotton, boyled in vinegre, bymistone, and Saltpeter,
whiche muste bee well roled in good serpentine powder
well dyed in the sunne: and hauing laide it to the place,
you must make a trayne of powder vpon it, euen to the
going out, so that it may bee couered therwith: placing
it in pipes of earth or tronkes of woode in the place of
the entrie therof: & that done, you must wall it by moste
strongly, laying ouerthwarte great blockes of okes or
other woode: so that with those & with the wall, it maye
bee strong to resiste the furye of the fire, as muche as
is possible: and the entrie in suche maner made vp and
fortified, when you shall thincke it time to bying the
effect

of fireworkes.

effecte to pas, to destroye the aduersaries, or to make a ruine, you may cause the trayne to be set on fire, where you shall see a maruylous and horrible effecte followe. Moze aboute this matter I neede not to declare sauing that if it shoulde chaunce the mygne to be made in a stonie place, where the stenes will fall downe; that then the best is to vnderprope them with pipes of wood filled full of powder.

¶ The maner how to make troumbes or trunckes of fyre, as well to assaulte as to defende a breache, or gate, and to set a fyre a towne or Campe or anye thing else.

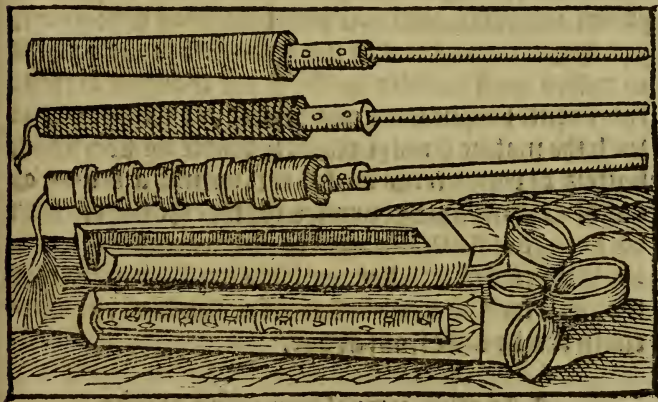
Cap. xxix.



First cause a cane of good wood to be made at the corners as big as a mans thigh and the length of an ell, after such sort that y^e hole therof be as wide that a man maye thrust in his naked arme, and cause that the bottom of the sayd tricke be made in suche wise with a litle hole, that the staffe of a

partesan may enter into it, and so to be made fast therunto, binding the sayde truncke with yron wyre at both endes, and in the middest soz moze suerty that it breake not, throught y^e fury of the fire. Then fil it with this mixture herc following. Take serpentine powder iij. pound rosen i pound, cāphere half a poūde, beaten glas iij. ounces, & mingle euery thing together, then begin to fil and put in the trumbe a handefull of serpentine powder vn-
mirted, nexte a handefull of the foresaide mixture, after a litle powder, then a stoppell of cotten wet in oyle of gineper, and put in vppon the sayde cotten as you haue done at the firste, that is to saye powder, and then mixture

ture &c. And thus you must doe till you haue filled it full,
 stamping in the stusse alwayes lightly, and if for lacke
 of gineper oyle you wet the cotton in aqua vita, it is very
 good putting after euery quantitie of powder a litle quick
 siluer, then when it is full, put in the mouthe some good
 powder, making it a single couer of parchement bound a-
 bout with packthred, & with a litle hole in the middelt of
 the parchement, wherin you muste put a matche made
 with gunpowder, the whiche easly and quickelye with
 your common matche may kindle the fyre, being come
 to the face of the enemy: whiche is an excellent thing
 for the fight on the sea, or for to disorder a band of horse-
 men.



¶ Howe to make bottels or pottes of fyre worke
 to throwe into shippes or among men
 that are in battelraye.

Cap. xxx.

off fireworkes.



Vch earthē bottels or pottes as is commonly vsed to kepe vineger oz oyle and such like is best for this purpose, whiche muste be filled with this composition: serpentine powder two partes , rosen one parte, pytche one parte , beating moste finelie , all these things together in a morter,

then take turpentine , & a litle gineper oyle , oz linsēde oyle, and mingel them therewith in a candion vpon the fire with a sticke of a yarde long, and fill the bottels half full of this soze sayde receipt, that done, take serpentine powder one parte, rosen one part, bzimstone halfe a part, pytche halfe a part, and of this last mixture the bottels oz pottes must be filled by: the in the mouthes of them there must bee put some good powder , so the intent that with the matche it maye quickly kinde the fire: which bottels oz pottes serue well to thzowc into a towne oz out of a towne amōg enemies, so that the fire of them bzreaking out flieth all abzoade and burneth most horribly where it lighteth, but good hēde must be taken that it be first well kindeled befoze it bee thzowen , in especially if it be caste from aboue.

¶ An other composition offire vvorke.

Cap. xxix.



Ause as manye earthen bottels oz pottes to bee made as you liste to haue , whiche must bee as it were but halfe baked, then fill them with this mixture following, serpentine powder thze partes , Saltpeter one parte , turpentine halfe a parte , pytche halfe a parte , bzimstone one parte, baye Salte halfe a parte, and

and when you will throwe them, set them on fire and see that they bee well kended.

¶ Balles of mettell to throwe among men in battelraye or otherwise, which breaking shall doo wonderfull hurte.

Cap. xxxii.



O disorder and to make the enemies to giue place, there maye also bee pꝛouided, certaine hollow balles of mettell as bigge as small boules, and a quarter of an inche thicke, caste in mouldes and made of thre partes of brasse and one of tinne: but the brasse oughte to bee molte befoze the tinne

be put to it, whiche balles filled halfe full of fine cozne pouder, and the other halfe full, of serpentine pouder mingled with rosen beaten into pouder, so that soz thre partes of serpentine pouder there be one part of rosen, and then puting in the mouthes of the holes of them a litle fine cozne pouder to make the rest to fire the sooner and after being fired and throwen, they will bzeake and flye into a thousande peces, and both hurt & kyll whom so euer is nere oz aboute them. Wherfoze they are verry good to throwe ouer the walles into a towne oz foztresse, oz into a campe, to hurte and to giue a terrour to those that are within: but these balles after they are fired and well kindeled, and hauing blowen a litle, must be quickly throwen, least they hurt such as would hurle them: and therfoze the experience of one, ought first to bee made in a close place, to see howe long it will tary befoze it bzeake, & the holes that it will make in diuers places, wherby the other maye the better bee

knowne howe to be used.

L. i.

Howe

of fireworkes.

¶ The maner how to prepare pottes and balles
off fyreworke to throwe with hande.

Cap. xxxiii.



IN the world there hath bene
alwayes men of such pꝛeng-
nant wittes, that haue excels
led in sundꝝ and infinite in-
uentions, as well foꝛ the sa-
uegarde of humane bodies
as also foꝛ the destruction of
ꝑ like. By whose helpe there
haue bene Capitaines, whi-
che imitating their counsellers
haue caused their footemen to carie in their handes, cer-
tayne earthen pottes and balles, filled full of a certayne
composition of pouder, oꝛ some vndius liquoꝛ, apte to
take fire quicke quicklꝝ: with the whiche incountering
the enemies in battaile at hande, haue vigoꝛously whoꝛ-
led those among them, foꝛ to pꝛoue, whether with suche
meanes they might bee able not onclꝝ to disorder them,
but also to make them giue place, and to ouerthrowe
them: foꝛ as muche as suche fyꝛe woꝛkes will marua-
lously hurte the enemies not onclꝝ with the smoke of
them, but also a great deale and muche moꝛe with the
hoꝛrible and vnquenchable burning of the; so that there-
by suche men haue alwayes had moꝛte happꝝe successe,
with moꝛte gloꝛious laude and pꝛayse. These fyꝛe
woꝛkes are made in this wise: Take as many earthen
pottes oꝛ boitelles as you liste, caused to bee made
foꝛ this purpose, either baked oꝛ unbaked whiche ma-
keth no matter, so that the moistenesse of the earth bee
dꝛied bp: and these muste bee filled halfe full of serpen-
tine pouder, and somewhat moꝛe: and the same pou-
der muste bee mingied with pytche and bzimstone bea-
ten to pouder to the quantity of the thirde parte thereof:
of:

of: then there muste be put vpon it a finger thicknes of hogges grease, to the intente that it maye make the fire to dure the lenger and it being in this maner ordered, there muste be made a hole into it and a peece of gunpowder put therein, with a littell good poulder, and firing it, and holding it so long till it be well kendeled, you shall then throwe it. Also there is made a liquide composition in a caulozon, wherein is put hogges grease, oyle of stoness, bzimstone, saltpeter twice refined, aqua vita, pytche, turpentine and some serpentine poulder: & the pitche, the bzimstone, and the Saltpeter being liquide, putting thereto the grease, the turpentine, the oyle, and the poulder ouer the fire, all muste be stirred and mingled together very well in an earthen pot, or some other thing prepared for the same purpose with a sticke, to the intente that it maye the better incozporate: and then it muste be conered aboute with good poulder, that it maye fire the easelier when you will haue it. And that done, you may occupie it when you wil, and whozle it either with a sling, or with a corde tied vnto it, or otherwise with the hande as you shall thincke best: also of this composition they maye bee filled certaine littell purses of linnen clothe, which being bounde about with a corde wil be fashioned lyke a ball: and these maye bee whozled or shotte oute of trunkes of fire, or otherwise as shall please him that maketh them. Also with this composition maye bee annointed whatsoeuer a man wold haue quickely burnt, as Gates of Tounes, bzidges of wood, cartes, monitions, and such like, for that it is a matter that will some kendeled and set a fire any thing, and also able to maintaine it: mozeouer littel balles thereof maye be tyed to the heades of dartes
to throwe among the enemyes, or
where one wold haue any
thing fired.

of fireworkes.



Howe to make balles of wilde fire , to shoote in
ordinaunce or to throwe with
handes.

Cap. xxxiiij.



Ake serpentine powder five
partes , Saltpeter refined
thre partes , brimstone two
partes , Rasapina one parte,
Camphere halfe a part, tu r
pentine halfe a parte , halfe a
part of glas grossely beaten,
baye Salte halfe a part, half
a part of oyle of stones , and
oyle of linte sæde , as muche
of the one as of the other, Aqua vitæ half a part, and all
these things being mingled together very well, take the
a peece of canuas as bigge as you will make the ball
and make it like vnto a purse, and fill it with the sayde
mixture , and then make two or thre holes therein
with a rounde pyon somewhat bigger then a bod-
kin,

bodkin, and put in euery hole a little sticke.

And it is to bee vnderstande that this foresayde mixture may bee also made vpon the fyre in a cauldron, and the balles that are made thereof must bee rouled in serpentine powder, and then in the mixture, often tymes couering them with Toe, well plaistered on, of a good thickenesse, then when they shalbe a litle dried, take the said sticke out of the holes, and fil them halfe full of serpentine powder, and the other halfe with cozne powder, and giuing fire to the saide balles, and thzowning them amōg the enemies, they will do many a plous & wonderfull hurte. For that the sayde balles will burne within the water, so that falling vpon the armour of souldiours, water cannot quenche them noz any thing else, except abondaunce of myze or durte. And adding to the saide mixture that is vnsof halfe a parte of beaten glas and halfe a parte of baye Salte, you maye fill a trumbe therewith after the maner as I haue taught a litle afoze.

To trime Targettes with fireworke to assaulte,
or to defende a breache.

Cap. xxxv.



Et pipes of brasle as manye as you liste, and nayle them vpo a target, either fixe viij. or x. and fil the sayde pypes full of the forsaide mixture vnsof, & order the pypes after suche sort that they fire not altogether, but one after an other, so y when one is almost burned oute, the same maye geue fire to an other by a litle pype as small as ones finger, that muste go from the bottome thereof to the mouthe of an other, and so successiuelye to all, whiche shall continue a long tyme, but the sayde target must be

of lutum sapientia.

be couered with blacke buckeram that the fyreworke
bee not perceyued and the giuing of fire the one to the
other.

¶ To make an other kinde of fireworke.

Cap. xxxvi.



Take willowe coles, Saltpeter, aqua vita,
byimstone, pitche, resapina, Camphere,
oyle of stones, vernice liquide, turpentine
as much of y one as the other, mingling e-
uery thing together, & the take a litle purse
of canuas, & fill it full of serpentine powder, & couer the
purse all ouer with the foresayde mixture of a good thic-
kenesse, and with as muche Toe as you shall thinke
good, and then make a hole that maye go to the middelt
of the balles, whiche muste bee filled full of powder, so that
therby all the composition therof with a matche maye
be set on fyre when you list.

¶ Howe to make a mixture in stone that shall kin-
dle fire with water or spittel.

Cap. xxxvii.



This stone is very necessary for a Captain
to giue fire to his gunners, when throught
soule wether, all their matches shoulde
happen to go oute, and where they can-
not kindle the againe because of the raine.
First take vndraked lime one parte, Tutia alexandrina
vnpprepared one parte, Saltpeter very well refined one
part, quicke byimstone two partes, Caphere two parts
calamite stone one parte: All these thinges muste bee
well beaten and sifted, and bounde harde together with
a peece of new linnen cloth, & put into a cople of earthen
cuppes, such as Goldsmithes vse to melte in, the
mon

mouthes of whiche muste bee ioyned together and faste bounde with yron wyre , and daubed ouer with lutum sapientia that it bzeathe not out, and then dried a litle, till it become yelow, that done , put it into a sozneys where they burne bzicke oz earthen vessels , and let it tarpe therin as long as the bzicke oz earthen vessels be a baking, and then taking it out, you shal see it made like vnto a bzicke stone.

¶ To make an other kinde of stone to kindle fire with water or spittell.

Cap. xxxviii.

TAke Camphere thre partes , Saltpeter well refined two partes, unslaked lime two partes bzim stone two partes, all these thinges (being well beaten together , and put into a cople of golde smithes melting cuppes well stopp'd with lutum sapientia) must then bee baked in a sozneys, and when the earthen vessels bee taken oute , this shall also bee made.

¶ Howeto make lutum sapientia.

Cap. xxxix.



Ake of the best white potters earth that you can gette; for in one place there is better then in an other, that is to saye , of that whiche can best endure the fire, as suche as they make pottes of in Padua, and likewise in Germany : for it is of suche perfection , that the Pottes, whiche bee made of it ., and wherein that they dresse their

of lutum sapientia.

their meate, may also serue to found metalles in. Take then of the beste, and specially if it must serue for a thing that hath neede to be long vpon a greate fire, other wise, take suche as you can get. There is founde of it, that is of a graye colour, as the common sozte is, and also there is white, that men vse in some place of Vicence, which is like loaues of Gispum, or plaister, and is called of the Italians Florette de Chio. **W**here here in Englande vppon the vse thereof, may geue it what name we will. Potters vse of it in Venise, for to whit the dishes, and other thinges, befoze they vernishe or pollish them. There is also founde of it that is redde, as in Apulia, where there is greate quatetie, and that they call Boale, and is the very same that some Apoticares do sell for Boale Armenick, & the Venecians vse of it, for to paint redde the forefrontes of their houses with lime, bzicke, and Vermillion, couering it afterwarde with oyle of line. This redde earth is the fattest, and the clammiest of all the rest, and therefore it cleaueth soonest by the fire, if it be not tempered with some other substance. And because that all the sayde earthes be to fatte, the one moze than the other, therefore menne put to them some leane substance. **P**owze, if you take of that of ashe coloure, whiche is moste commen, and the least fatty, you maye compose and make it in this maner: Take of the saide earth foure partes, of cloth-makers flore or shearing, one part, ashes that haue serued in a buck, or other, halfe a parte, drie horse dung, or the dung of an Asse, one part. If you will make it parser, put to it a fewe stamped bzickes, and sparkes of yron: let all these thinges be well stamped, and sifted, that is to saye: the earthe the ashes, the horse dung, the bzickes, and the sparkes of yron: than mingle all together, and make it into earth, and make a bedde thereof, vppon the whiche you shall caste by littel and littel, the flore, as equally as you can. This done, powze to it wa-
ter,

ter, styng it well first with a sticke, & then with a pal-
lot broad at the ende. And when all is well incorpora-
ted together as you woulde haue it, laye it vppon some
great boorde, and beate it well, and that a good space with
some great stasse or other instrument of yron, mingling
and steering it well, for the longer you beate it, the bet-
ter it is. By this meane you shall haue a very good claye,
for to lute or clay, and ioynе violles, flagons of glasse to
still with, and bottels of gourdes for stilling, and other
great thinges, as founnells and such like. But he that
will make it with moze ease, let him put the earth onely,
the flore, and the horse dong, with a fewe ashes. Some
put no horse dong to it, and some no flore, according to
the purpose that they make it for. For to stop and close
vp the mouthes of stilling glasses, or violles, to the intent
they take no vent on the fire, the sayde clay will be very
good: neuerthelesse men put to it two partes of quicke
lime, and the whites of Egges, and then it will be surer
to let nothing vent oute but the glasse it selfe. All kinde
of clay or earth would bee kept moiste, and ready dressed
for him that will occupye it continually, but it must not
bee kept to watery, nor yet left to drie, for then it would
serue for nothing, seeing that after it is once hardened, a
man can not dresse it any moze to do any good withall.
And when you put water to it, it is mollified by litle &
litle aboue, and is as it were a sauce, but within remay-
neth harde, and if you put to muche water to it, you
marre it vtterlye. Therfore, when you see that it begin-
neth to ware drie, feede it a new litle and litle with wa-
ter, styng it till it bee well, and so shall you make it
perfecte.

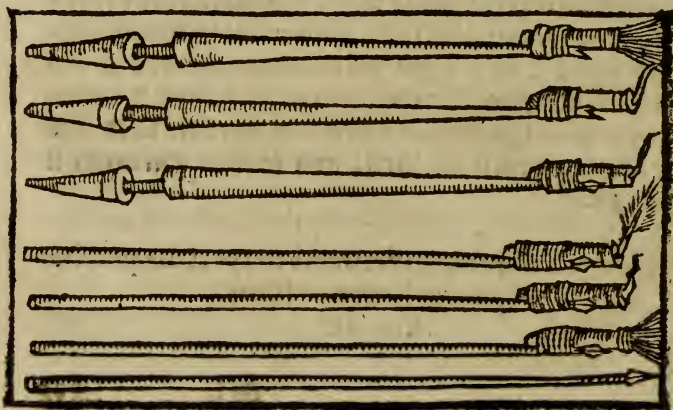
¶ How to make certayn fireworke to tye at the poinctes
of pikes or horsemen staues.

Cap. xl.

of fireworkes.



Or to assaulte or to defende a breache, and also to worke some policie in the night against the enemies, it is sometimes good to tye at the pointes of pikes or launces, certayne canes like vnto squibbes made of paper vpon a foyme of wood as long as the breadeth of a sheete of paper, filled full of serpentine powder, amongest the whiche muste be mingled litle peeces or crummes of pitche, of brimstone, graynes of baye salt, filings of yron, and beaten glasse, arsenic, cristall beaten to peeces, and suche like, and after they are closed vp, and tied faste at one of the endes, this composition muste be well beaten into them, with there owne formes or mouldes: vnto every one of which there must be put a good matche sod in Saltepeter and Gunnepouder, and then well dyed, and fastening them to stauess, after such sorte that the issue of the fire be tourned towarde the aduersaries, when you thinke good, you or some other may fire them: wher you shall then see the fire blow out fower yardes long, which in the night will seme terrible: but in a calme wether, or at least when the winde is in the faces of the enemies they are best to be vsed. And mozeouer for the fighte on the sea, they are moste excellent.



¶ Howe to make diuers compositions of fireworkes.

Cap. xli.



Very thing that will quickly burne, and that by some proper vertue is apte to multiplie fire, and maintaine it, may be put in fyre compositions: for y in effecte of such thinges they are made: of whiche thinges there are some that are minerall, as Wyimstone, and the oyle therof, and saltes

peter, & some other substaunces, hot, drye, & thin, & some vndius, as grease, and all soztes of oyles: some very dry, as pitch or wood: and of these there be some natural, and some artificiall: But now leauing to seeke suche difference of theyr compositions, among as many thinges as well old as new y I know, I haue found only these: out of whiche I haue chosen some of the notablest, specially these, that for to make them, there muste be take Rosen, Alchitrean, quicke Wyimstone, tartar, sarcocolla, Saltpeter, and oyle of stoness, and of euery one some parte, but double so much of vnslaked lime, & al must be compounded with the oyle of egges: and put into a vessel of glasse or of earth that is leaded, & covered very wel: putting it after vnder hot dung for a moneth: the taking it from thens and setting it ouer a soft fire, the vessell being well stopped, it muste be melted: which done, the licoz thereof may be put into hollowe stauces, or in yearthen bottells, or other vessells made of purpose: vnto euery one of which, must be put a peece of a gunpowdered matche, in the middell with some gunpowder also, to the intent that they maye the easelier fire.

Also there may be made an other sozte of fireworke after this maner: taking Wyimstone, or oyle of Wyim-

¶ ij.

stonz,

of fireworkes.

Stone yf it maye be had, oyle of stones, or of the same
stone Oyle of Juniper, Saltpeter very well refined:
and for euery porcion of suche thinges, five of asfalt:
and moreouer gorsegrease, pure pitche, vernis, powder
of pigeons dunge, and so muche aqua vitæ, that maye
thoroughly moyste all the foresayde thinges: which then
muste be putte into a vessell of glasse, and the mowthe
thereof well stopp'd with ware, and then put vnder a
hot dunghill. .xxv. or .xxx. dayes: and after to make
it the better incorporate, it wolde be set ouer a softe
fire: and that done, this composition maye be put into
hollowe stauens, or yearth'n pottes or like vessells to
be thzowen with the hande: also there maye be taken
a bullet of stone with a ring fastened therein, where-
vnto wolde be tied a corde of a yarde long: and aboute
the same stone, putting Toe imbrwed with the fore-
sayde composition, or ells pæses of linnen clothe all to
rayed therewith, whiche tiring, when it is well kende-
led, maye then be thzowen. Also balles of this compos-
ition maye be shotte in pæses of ordinaunce, or a stone
that hath a ring of yron fastened in it, to the which ring
may be tied a pæce of a rope steeped and sod in the fore-
sayde composition, or ells a littell bagge full thereof,
which maye be shotte or thzowen as one liste. Moreo-
uer balles of this, being made with linnen clothe as a-
foze is shewed, may be caste with all sortes of slinges
which way one will.

Also there is made an other composition in this
maner, with vernice liquide, oyle of quicke Brim-
stone, and oyle of the yelkes of egges, turpentine oyle, ju-
niper oyle, linsæde oyle, and olium saxum, or oyle of
stones, and haulfe as muche of aqua vitæ as all the saide
compositions: and also as muche powder of bayes fine-
lie beaten as will suffise to thicken all, with as muche
more Saltpeter: and all these thinges muste be put to-
gether in a vessell of glasse, or some vessell of yearth lea-

ded with a littell mouthe, which with ware muste be so stopped that it vent not : and this must bee kepte after three monethes in hotte dung, to putrisie, remouing it euery moneth so wye or five times, and shaking it together euery time: and this matter being broughte in such wise, when you will occupie it, it is requisite that you anoint the same thing that you will vse, or to put thereof into that vessell, where you will haue the fire to worke: for that the same fire is suche, that putting thereto some gunnepowder, or a gunnepowdered matche, it wil straight waye kendell : and it is so vnquenchable, that it burneth till hee, or the thing that it lighteth on, bee altogether consumed: and if this composition fired, chaunce to be thowen and lighte vpon armor, it will make it so glowing redde in suche sorte, that he that hath it on his backe, shalbe constrained to put it of, if he will not be burnt to death.

Also there is made an other sorte : and it is a moste thinne liquoz apte to fire, with the whiche if in the canicular daies a peece of woodde, or other thing apte to burne bee anointed, the heate of the Sunne is then able to set it on fire, and to burne it: and so sone as it is touched with fire, it kendealeth incontinente, and is vnquenchable: excepte it be choked bp with sande, or wet with very stale vzin, or moste strong vineger : also it will burne in the water: the making, whereof is in this wise : there muste be taken Camphire, oyle of quicke Wymstone, oyle of turpentine, oyle of dunge, oyle of iuniper, oyle of stoness, oyle of linteledde, alchitrean, colofonia, moste finelye beaten, oyle of egges, pitche, gosse grease, Saltpeter, and as much aqua vitæ as all the rest of the composition, and as muche arsinik, tartar, and armoniack salte, as the eighthe parte of altogether.

Which thing muste bee put into a glasse or pot wel stopped, and then set to putresie in a hotte dunghill for the space of twomonthes: and after al the forsayd thinges must

Of fireworkes.

musse bee distilled with a gentle fire: where within viii. houres, there will come of those thinges a mosse suttill liquoz, into the whiche putting then so muche oredung dried in an ouen and mosse finelye beaten to powder, as maye make it so thicke as sope or some what thinner: and after minding to occupye it, the thing that is to bee burnte, musse bee annoincted therewith: and this also the Sunne will set on fyre, and burne what so euer is neer it.

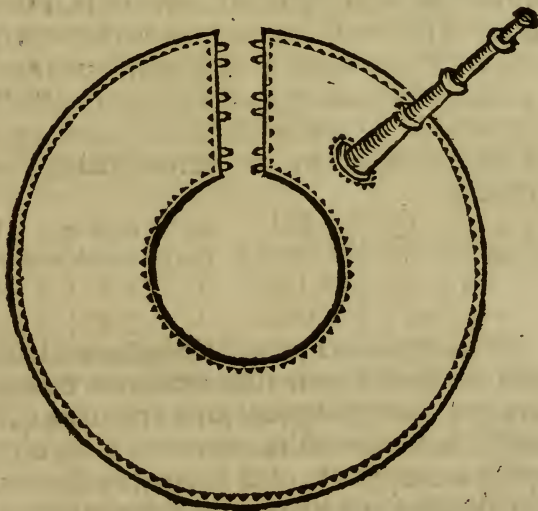
Also there is an other composition of fyre, that anye thing that is annoincted therewith, will maruaylouslye burne and fire with wetting of raine, or otherwise: whiche to make, there must bee taken new whitelime made of flinte, calamite made to powder by fyre, vitrioll grosse beaten the twow and thirteth parte, Saltepeter refined eyght partes: and as muche Camphere as all the foresayde thinges: oyle of quicke bzimstone: oyle of turpentine, Salte armoniacke, by waighte as muche as the vitrioll, and as muche tartar and baye Salte: Salte of bzin, Aqua vitæ made of strong wine as much as all the rest of the composition: the which thinges compounded together, musse bee put like as the other were, into a great glasse well stopped that it bzeath not oute: and then it musse bee set in a whote dounghill for twow or thzee monethes, removing the glasse and chaunging the dounge at leasse euerye tenne dayes, to the intent that the same matter maye ripen well, and bee like vnto a liquoz all of one thing: the whiche after oughte to be boyled so muche vpon a softe fire, that all the oyle humidentie, and other moystenesse that is in it, maye vapoz awaye, and the rest to become drie and stonye: and when it is drie and stony, bzaking the glasse & taking it out, it must bee grounde to powder: the whiche when it is to be occupied, must be strawed vpon the place that is dressed for the same purpose, so y it being rayned vpon or any maner of waies wet, will kindle & fall on a fire.

Howe

¶ How to make a girdle for Souldiours or Fishers whereby they may go in the water and passe ouer a riuer without either bridge or bote.

Cap. xlii.

This Girdle oughte to be made according to the fashion of the figure next following, and of such lether that muste be dyessed in like sorte, as the same is where with scotebals are made: where vnto a pipe muste be fastened like vnto a baggepipe, so that the girdle, when it is girte about a Soudiour vpon his armour, maye be blowen full of winde: by helpe whereof, he maye then safelye passe ouer a riuer, going thzough the same, howe deepe so euer it be, where he shal not sinke in the water, further then from the girdle steepe downe warde: whiche for men of warre, is verie commodious and a most necessarie thing.



Of sending aduise.

¶ How to write, and cause the same that is written to be read a farre of without sending anye message. Cap. xli.



Hen a Capitain were so besieged of enemies in a towne or fortreffe that no man coulde come vnto him, or be sent frō him with letters, wherby his minde, or the distresse and inconuenience that hēe is in, might of his friendes bēe vnderstande. Yet his minde being witten, maye of thē not

withstanding in the night be read, as farre of as a lighte can then be sēene, and by daye, as farre as a burning glas can caste the sunne, or a hat or any other such like marke maye perfectlye bēe decerned, so that the order therin bēe firste knowen and agreed vpon betwēn both parties. The maner in doing it in the night, is thus: hēe that giueth the aduise, muste holde his letter in the one hande wherin his minde is reēdy witten, and one lighte or y. lightes in the other hande, and the other that should reade and copy the same, ought to haue paper, and penne and inke with this a b c, et c. heresollowing, and vnderstande:

a b c d e f g h i k l	m n o p q r s t v w
this part of letters vvith 1. lighte, &	this part vvith tvvco lightes.
1 1 1 1 1 1 1 1 1 1	2 2 2 2 2 2 2 2 2 2
1 2 3 4 5 6 7 8 9 10 11	1 2 3 4 5 6 7 8 9 10

And for the plainer vnderstanding hereof, it is to bēe noted that the first parte of the letters are shewed with one lighte, and the seconde parte beginning at, M, are signified with two lightes, and euerye letter of the a b c muste bēe vnderstande, and knowen by the number or often shewing and hiding of the lighte or lightes: As for example, if this woorde, Man, were to be witten, because

Offending aduise

because M is the first letter standing in the second part, M muste be signified by two lightes shewed once, and then hidde, and staied so long as maye be thoughte that he that doeth coppe after the lighte so seuerallye shewed, and the number diligently marked, maye haue conuenient time to write M: then one lighte being shewed once, and so hidde and staide, a muste be written: for that a is the first letter in the first parte: and againe two lightes being shewed twice and stayde, n, oughte to be written, because n is the second letter in the second part: whiche done, there shalbe written Man. And thus by marking well the number of shewing, hyding and stay-
ing of the lighte or lightes, the letter that thereby is signified, maye mooste easely be vnderstand and perceyued. So that after this sorte, there maye be expressed and written what so euer a man liste.

To the Reader.



Hen the Britons the auncient inhabitauntes of this Ile (for lacke of skillfull men of vvarre of their owne, being afraied of the Franki, & Burgundi, vvvhiche vvvere certaine Barberous natiōs; vvho at the time ouer ran, spoiled, & possessed Frāce) caused the Germaine people, called Angly to come to ayde and defende them, by vvwhose procurement the Angly vnder Vortiger their King, taking vpō the the same enterprife, after they had ones defended them, did then incontinente drine them out of this Islande, remaining here them selues to inhabite: and after their name called it England: euē as also of later daies, the like chaūce happened to the Greekes, by calling in the Turckes to helpe them against their enemies. VVhich exāples, vvith innumerable like being vvell considered, do most manifestlie shevv, hovv daungerous & pernitiūs it is for a Prince and his Realme, to be druen to truste to the seruice of straungers, for lacke of sufficient skillfull men of their owne for their defence. VVnerfore sithens my intent in setting fourth this booke of Martiall affaires, hath beene onely to the ende to declare my good vvill, to haue my naturall cōntriemen not to bee inferiour to anye in vvarlike knowvledge, but rather to excell in the same, vvherby vvithout aide or helpe of any forein nation, vvee may alvvayes bee most renouvmed and famous, I shall beseeche all gentil readers, for this my labour done for their cōmodities, to iudge and reporte therof accordingly. And although my doinges herin, be not correspondēt to my desire, nor to the satisfactiō of euery mās minde (vvvhich vvvere impossible) yet my trust is, that some neuerthelesse by diligēte reading therof, and imitating the example of Lucullus, (vvho chiefely by studie of like bookes, in very shorte space, became one of the valiantest and vvorthiest vvaiour of all the Romanes,) may if they list, take commoditie and profite, vvhereby the knowvledge in vvarres, may of such as neuer haue bene trayned in them, be the more easily gotten and attayned. For vvvhich cause, my indeuour and trauayle taken herein, for to profit this our common vveale, deserueth not vtterly to be despised, seeing that the most verteous life, and gouernement of Alexander Seuerus Emperour of Rome, vvith manye other Princes, and common vveales, could not, being negligēt in this kinde

make accompte in fayre vweather, of the
tempest to come.

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1. The first part of the paper is devoted to the study of the properties of the function $f(x)$ defined by the equation

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THE UNIVERSITY OF CHICAGO

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¶ The table of the additions.



Perfekte rule to bring men into a square battell, of what number so euer they be. fol. ij.

To knowe howe many men may march in a rancke, & at a suddaine to bring the into a fower square battayle, so y their

Antigne, maye come to be in the middelt. iij.

Howe to ordayne a number of men or an armie into a battayle, like vnto a wedge, or thre square, so that it maye be apt to marche with the point e therof toward the enemies. vi.

To make the battayle called the Sheres, whiche in olde time they vsed to set against the Triangle. vii.

What auantage it is to order me in a triangle battayle against the enemy, that knoweth not howe to make the battayle called the Sheres to set againste it, in especiall where there is as many men of the one parte as of the other. viii.

To bring a number of men or an army, into a battayle, whiche in olde time was called a Sawe. ix.

To fashion a battayle of a number of men or an armye like vnto two Triangles ioyned together, so that they may be apte to march with a corner thereof toward the enemies. x.

What is best to be done where the ordinaunce of the enemies being shot into the Armye hath slayne many men. xi.

Howe to chaunge with speede an armye, that is, in batelray fower square, into a Triangle fashion, without disordering the first ranckes, and without perill of confusion. xii.

Of the perfecte forme or fashion of strong places. xvi.

The strongest and perfectes fashion of all other for the building of y cortin or wall of a town or fortresse. xviii.

An example of the quadzantz forme to proue that it causeth

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- causeth debilitie and weakenesse. rrii.
- Of the nature of Saltepeter, and the manner howe to make and refine it. rriij.
- The manner howe to make all sortes of Gunpowder. Fol. rrvj.
- The manner that is vsed of charging and shooting of ordinaunce. rrriii.
- Howe to gette oute quickly the nailes that should happen by Treason, or otherwise to be giuen into the toucheholes of ordinaunce. rrriiij.
- Howe much the artillery ought to be esteemed of the armies nowe adaiies, and whether the same opinion of them which is had vniuersally, be true. rrriiij.
- Of Mines and placing of Powder vndergrounde, wherewith inuincible Fortresses, by fire maye be ruinated, when ordinaunce cannot be broughte vnto them. rrrviij.
- The manner howe to make trombes or trunckes of fire, as well to assaulte as to defende a breach, or gate, and to sette a fire a Towne or Campe, or any thing elles. rrrix.
- Howe to make battells or pottes of fireworke to throw into shippes, or among menne that are in battellraye. xl.
- An other composition of fireworke. xl.
- Balles of mettell to throwe among men in battellraye or otherwise, whiche breaking, shal do wonderful hurte. xli.
- The manner howe to prepare pottes and balles of fire worke to throwe with hande. xli.
- How to make balles of wilde fire, to shote in ordinaunce or to throwe with handes. xlii.
- To trimme Targettes with fireworke to assaulte, or to defende a breach. xliij.
- To make an other kinde of fireworke. xliij.
- Howe

The Table of the additions.

Howe to make a mixture in stone that shall kende fire
with water or spittell. xliij.

To make an other kinde of stone, to kende fire with
water or spittell. xliij.

Howe to make lutum Sapientia. xliij.

Howe to make certain fireworke, to tye at the poyntes
of Pikes or Horsemen staues. xlv.

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sage, or to printe to printe. xlvij.

The ende.

¶ *Imprinted at London, by*

W. W. Williamson: for

Thos. Wright.

¶ *Anno salutis. M. D. LXXIII.*

Menſe. Septembris.

No. 1000

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